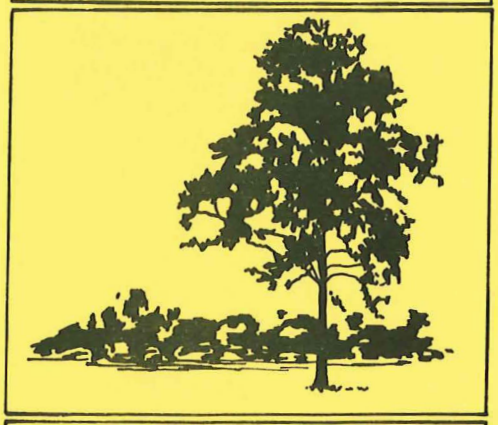
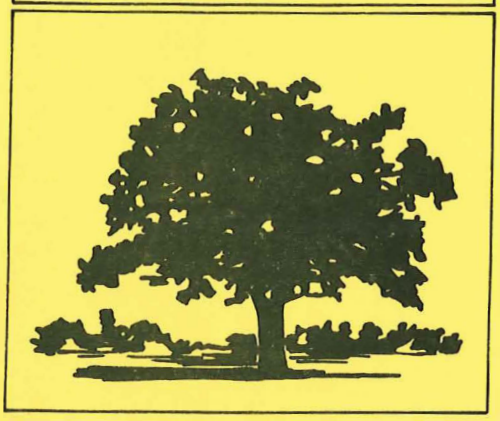




DEPARTMENT OF NATURAL RESOURCES
BOX 7921
MADISON, WISCONSIN 53707

FOREST PEST CONDITIONS IN WISCONSIN

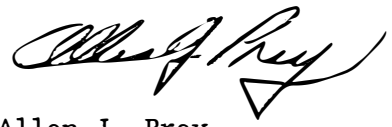
ANNUAL REPORT 1987

ACKNOWLEDGEMENTS

This record of the activities of forest pests and other destructive agents of growing trees in Wisconsin's forest nurseries, plantations, and natural timber areas was made possible by the dedicated work of pest management personnel in each district and at the Forest Pest Management Laboratory in Madison. DNR foresters, other Department field personnel, cooperators in other public agencies and private forest industry contributed valuable assistance in monitoring the forest lands in all classes of forest ownership.

There was a personnel change in the forest pest management program in Wisconsin in 1987. Frank S. Morse, stationed at Black River Falls, Wisconsin, retired after 37 years of state service. Plans are to move the station from Black River Falls to the DNR District Headquarters at Eau Claire, Wisconsin.

Preparation of this Annual Report was a result of a team effort involving William Kearby, Frank Morse, and Shane Weber, DNR District Entomologists who submitted district reports. Jane Cummings Carlson and Dave Hall, Forest Pest Unit, Madison, consolidated the district reports and wrote the final draft on personal computers. John Trobaugh, Forest Pest Unit, prepared the computer generated and hand drawn maps, and Anita Canfield of the Southern District Program Services completed the word processing. Final printing was done by the DNR Bureau of Program Services.



Allen J. Prey
Supervisor, Forest Pest Management
April 14, 1988

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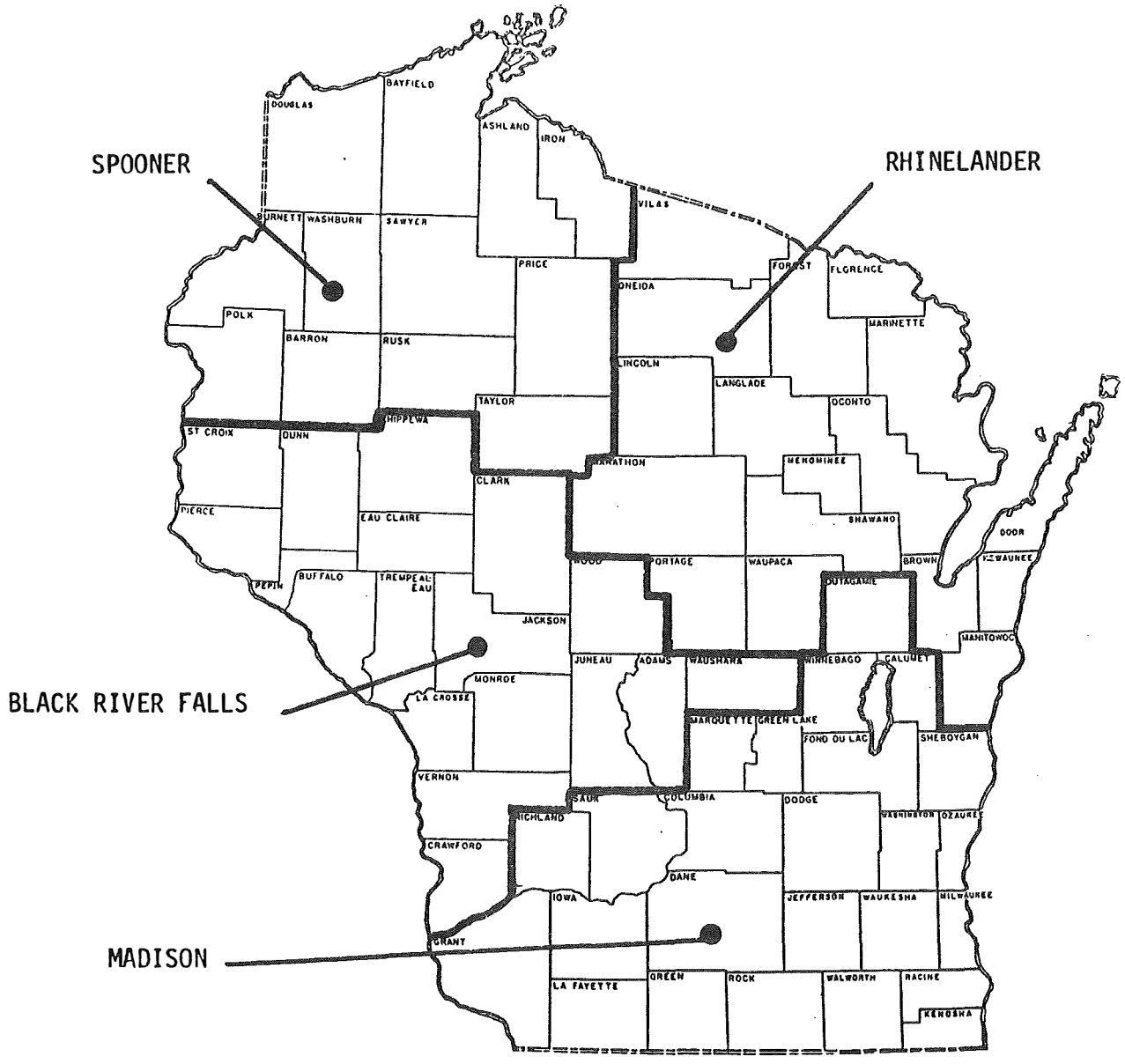

Figure 1. Station locations of Wisconsin Department of Natural Resources District Entomologists and Forest Pest Unit Personnel.

Department of Natural Resources
Forest Pest Management Personnel December 31, 1987

Name	Title	Address	Telephone
Prey, Allen J.	Supervisor, Forest Pest Management	DNR, 3911 Fish Hatchery Road, Madison, WI 53711	(608) 275-3274
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Cummings Carlson, Jane E.	Forest Pathologist	DNR, 3911 Fish Hatchery Road, Madison, WI 53711	(608) 275-3273
Trobaugh, John R.	Lab Technician	DNR, 3911 Fish Hatchery Road, Madison, WI 53711	(608) 275-3237

****

Kearby, William H.	Forest Entomologist	DNR, Box 818 107 Sutliff Avenue Rhinelander, WI 54501	(715) 362-7616
Morse, Frank S.	Forest Entomologist	DNR, Route 4, Box 5 Black River Falls, WI 54615	(715) 284-1419
Weber, Shane D.	Forest Entomologist	DNR, Box 309 Spooner, WI 54801	(715) 635-2101
Storandt, James F.	Assistant Nursery Superintendent/ Pathologist	DNR, Griffith Nursery 711 Nepco Lake Road Wis. Rapids, WI 54494	(715) 424-3700

Introduction

This report lists the major insect and disease problems reported on forest land in Wisconsin in 1987. While this report does not list all the insect and disease problems that occurred on forest land, it does highlight major or noteworthy insect infestations, and disease occurrences including abiotic damage to trees.

In addition to surveying 10.2 million acres of forest land for pests in 1987, DNR district entomologists and forest pest staff continued to teach integrated pest management principles to DNR foresters, industrial foresters, and private woodland owners. Approximately 1,630 individuals were trained at 27 sessions in 1987. For example, oak pest management training sessions were held at Spooner and Wausau, Wisconsin in July.

A Christmas tree insect and disease diagnostic booth was set up at the Wisconsin Christmas Tree Producers summer meeting at Madison. Approximately 75 growers were assisted with problems and approximately 100 growers were trained on how to identify and control insect and disease pests during the summer convention field trip. Christmas tree insect and disease information was also presented at the Christmas Tree Producers winter meeting in Oshkosh, Wisconsin in January. Similar forest pest exhibits specifically designed to provide technical assistance for woodland owners and the general public were displayed at the Wisconsin Woodland Owners Association (WOWA) annual meeting in Dodgeville in September. The Southern District entomologist attended a WWOA field day in Columbia County and gave a talk on insects and diseases. He also attended a meeting of the WWOA Educational Committee.

A training session on "Detection of Diseased and Defective Trees to Reduce Power Line Fires" was presented to 40 tree maintenance workers of the Wisconsin Electric Company Iron-Mountain Division at Iron Mountain, Michigan. The forest pathologist also participated in a meeting of the DNR Task Force on Reducing Power Line Fires, submitted a draft of a chapter for the DNR handbook, and the script for a slide-tape training session.

Lectures and laboratory sessions in forest entomology and forest pathology were presented at the UW-Stevens Point. Also a lecture on integrated pest management of forest diseases in Wisconsin was presented at the UW Extension pesticide applicator certification courses held at Spooner and Stevens Point in February.

A slide series and lecture titled "Your Friends the Insects" was presented at the Devil's Lake State Park and Wisconsin State Fair in August, and at the elementary school in Oregon, Wisconsin, in September.

Presentations concerning the History of Insect and Disease Pests of Sugar Maple in Wisconsin were made at University of Wisconsin-Extension Sugar Maple Institutes held in Shawano and Wausau. The status of maple decline survey projects in Wisconsin was presented at the North American Maple Syrup Council meeting in Duluth on October 24, 1987. Also a seminar on the maple sugar bush dieback and decline survey in Wisconsin-1987 was presented at the Department of Plant Pathology, UW-Madison.

The forest pathologist gave a presentation to the American Chestnut Foundation members in St. Paul, Minnesota on the status of chestnut blight in Wisconsin.

The forest pathologist and North Central District entomologist attended the International Tribal Council Meeting of Native Americans at Green Bay, Wisconsin, and set up a forest pest problems display on the major pests present on the Menominee Indian Reservation.

A draft of Integrated Pest Management Manual for Pine Pests in Wisconsin was completed. This manual will be published by U.W. Agriculture Journalism and distributed to DNR foresters and Wisconsin Woodland Owners in 1988.

The Southern District entomologist co-authored, with UW-Extension, a handout sheet, Herbicide Recommendations for Forest Tree Plantings on CRP Lands. He also co-authored a paper on Saratoga Spittlebug which will be published in WWOA magazine or Northern Journal Applied Forestry. A new herbicide table, "Herbicides for Plantation Management" was published as a UW-Extention handout sheet and handouts for managing eastern pine shoot borer and white grubs were distributed statewide.

The forest pest staff participated in various national and regional meetings and conferences in 1987, such as the National Phytopathological Society annual meeting in Cincinnati, Ohio, and the Northeastern Nurseryman's Conference in Hayward, Wisconsin.

Sugar maple decline was examined in Ontario and Quebec by forest pest staff. It was an excellent opportunity to exchange ideas on symptoms, survey techniques, and possible causes of decline with forestry scientists from Canadian provincial and national agencies.

The forest pathologist, attended a Women in Natural Resources conference in St. Paul, Minnesota, as part of her duties as chairperson on the Women in Forestry Committee for the Society of American Foresters (SAF). She also surveyed the Wisconsin women in SAF on current issues and concerns, and attended the State Society meeting at Duluth and the national meeting in Minneapolis where she designed, set up, and tended the "Women in Forestry" display.

Forest pest staff participated in the Wisconsin Nursery Disease Control SWAT team meeting in Hayward. They presented the results of survey work completed in 1986 and 1987.

Wisconsin DNR Forest Pest Management hosted the North Central Forest Pest Workshop at Eau Claire, October 13-14, 1988. Approximately 80 individuals participated in lectures at the Civic Center Inn and a field trip that was held in Dunn County to examine hardwood and conifer problems.

The Pest Management Unit hosted a delegation of forest entomologists from Shaanxi Province, People's Republic of China, in November. They were shown red pine pocket decline and other pest problems in the Spring Green area.

DNR pest staff cooperated with DNR Solid Waste Management on identifying materials for pick up and disposal at DNR stations, supplying herbicide

information to foresters and wildlife managers for 1987 projects and planning for construction of a new pesticide storage facility at the Griffith State Nursery. Pest staff also met with the Wisconsin Christmas Producers and the Wisconsin Department of Agriculture, Trade and Consumer Protection on obtaining a use permit for Lindane on white pine and spruce and prepared the application procedure for the DATCP on Lindane for white pine weevil control. Pesticide storage facilities on DNR properties were inspected by district entomologists for compliance with state and federal regulations.

The Wisconsin DNR Forest Pest Advisory and Steering Council toured a gypsy moth infested area in and around Midland, Michigan, on June 12, 1987.

The North Central District entomologist served on the DNR Biotechnology Committee and attended one Biotechnology Training course in Madison, covering the types of technology, federal and state regulations, and the future.

ASH

Ash Yellows - Mycoplasma Like Organism (MLO)

Ash yellows was identified for the first time in Wisconsin at two locations, (Waukesha and Marathon counties) (Figure 1).

In Marathon County, (NWSW, Section 21, T26N, R6E), the MLO was identified from root tissue of white ash. The affected trees were within a 140 acre stand of mixed hardwoods (aspen, oak, ash and red maple). Deliquescent branching and sprouting were observed on one white ash (10" dbh).

In Waukesha County, (T8N, R18E), declining white ash trees were scattered throughout wooded lots within the Village of Chenequa. The MLO was identified from two trees with twig and branch dieback, and small chlorotic leaves. No witches brooms or deliquescent branching patterns were observed.

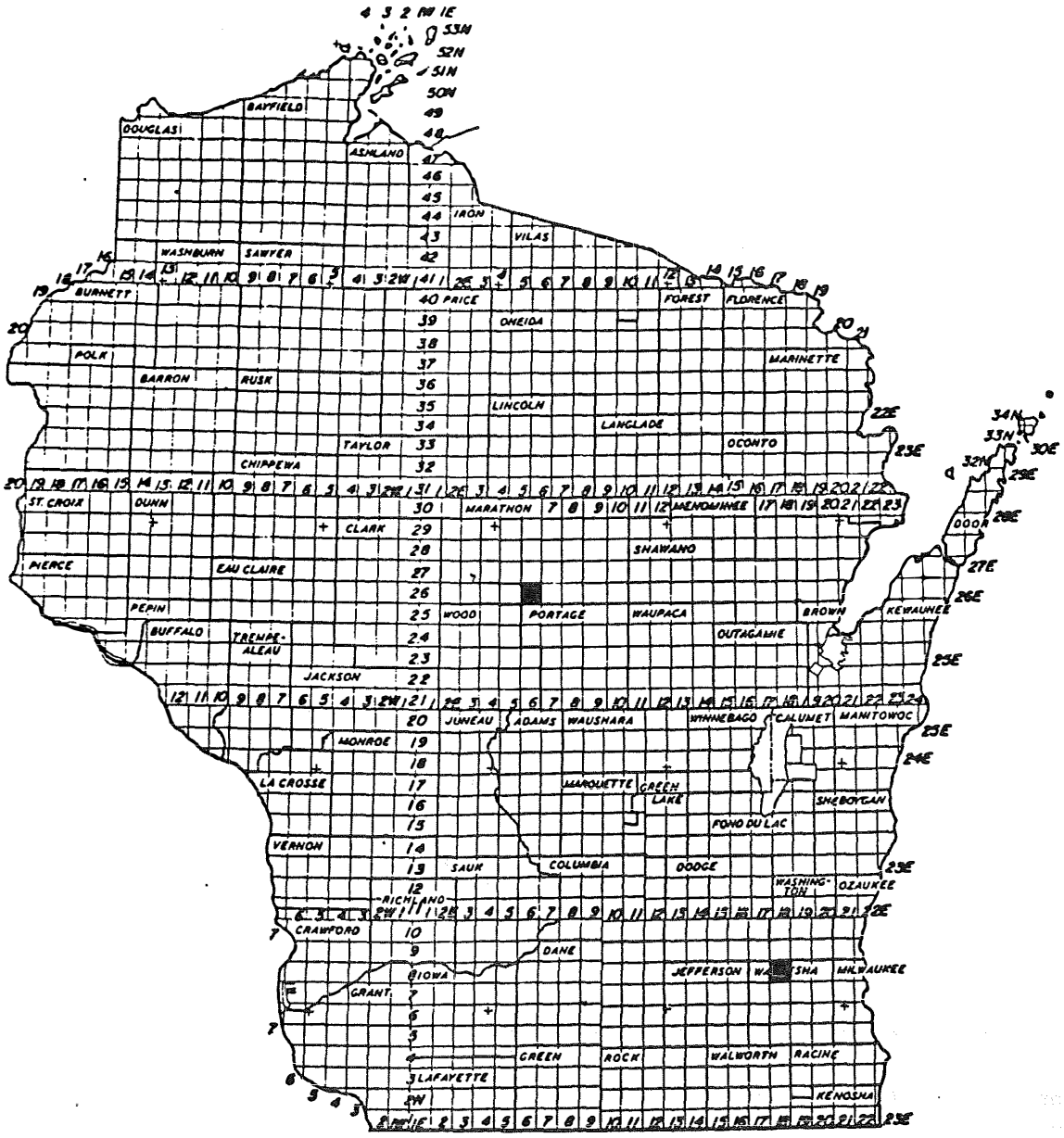


Figure 1. Known township locations of Ash Yellows - 1987.

ASPEN

Aspen Bronzing - Unknown

Aspen bronzing symptoms were observed for the first time in Washburn County in 1987 where two big-tooth aspens were affected in Section 30, T40N, R13W, and two big-tooth aspens showed symptoms in Section 27, T40N, R10W (Figure 2).

As in 1986, bronzing symptoms were observed in Barnes Township (T44N, R9W), Bayfield County, east and west of State Highway 27. Incidence of bronzing increased on trees affected in 1986, and newly affected trees were observed throughout the area.

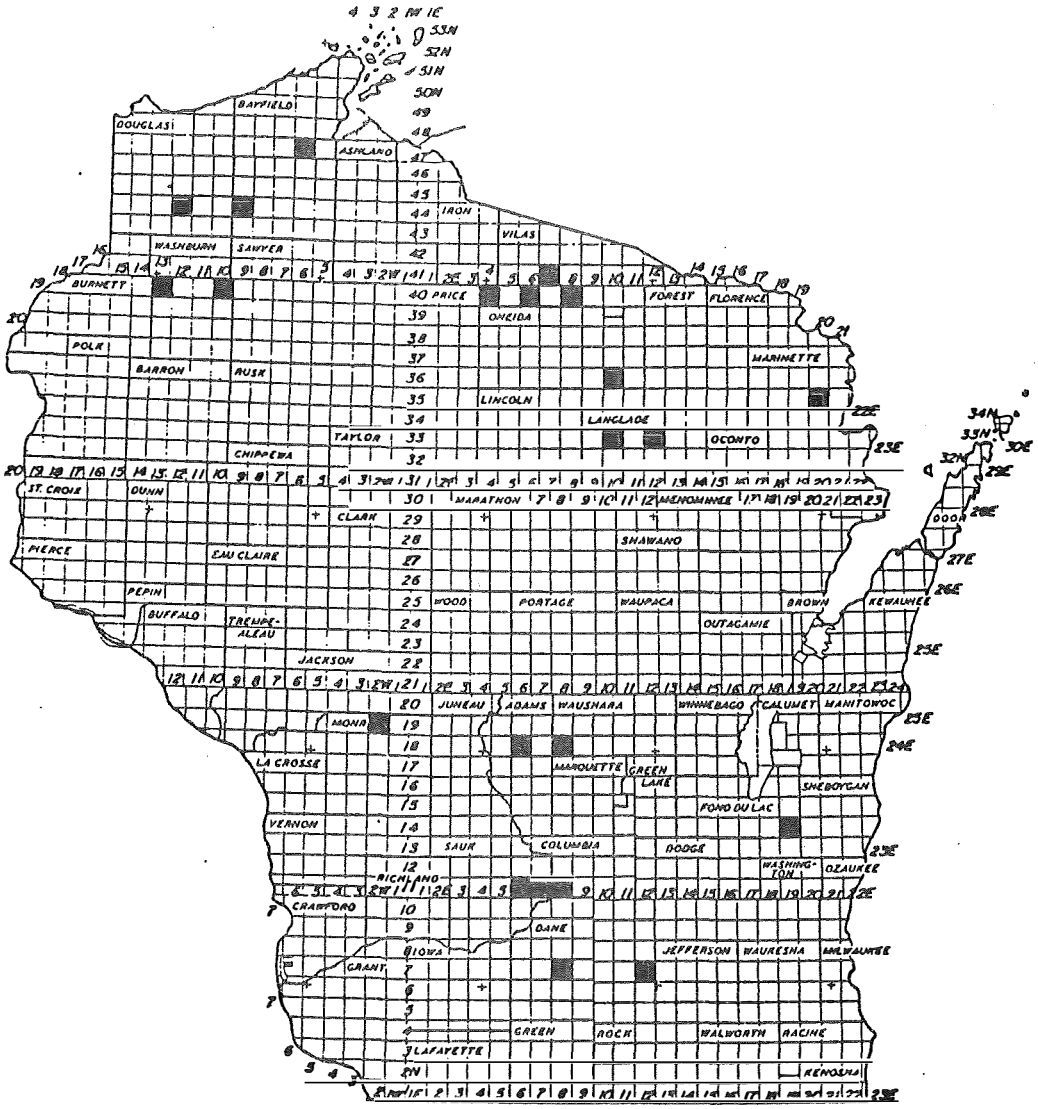


Figure 2. Known township locations of Aspen Bronzing - 1987.

Aspen Blotchminer - Phyllonorycter tremuloidiella (Braun)

Populations erupted over most of the northern counties. Noticeable mining of quaking aspen foliage was reported in Vilas, Douglas, Bayfield, Sawyer, Ashland, Price, Oneida, Forest, Langlade and Lincoln counties. Damage was limited to the lower crowns in some areas.

Forest Tent Caterpillar - Malacosoma disstria (Hubner)

A new outbreak which began with a small pocket of defoliation in Langlade County in 1986, erupted to cause light to heavy defoliation of aspen, red oak and paper birch in Menominee, Marathon, Marinette, Langlade, Oconto and Florence counties (Figure 3). Defoliation was scattered over 850,000 acres and occurred on 15,500 acres in Menominee County alone. Heavily defoliated red oaks refoliated by mid July but leaves were 25% of normal size, crowns were thin and some branch dieback was apparent.

Phenological notes:

May 6 - Larvae in first instar in Oconto County.

June 3 - Larvae starting to pupate in northeastern counties.

Figure 3. Area of defoliation by the Forest Tent Caterpillar - 1987.

BALSAM FIR

Spruce Budworm - Choristoneura fumiferana (Clemens)

No defoliation was observed anywhere in Wisconsin. The population that caused light defoliation in Ashland and Sawyer counties in 1986, collapsed.

Balsam Gall Midge - Paradiplosis tumifex (Gagne)

Populations continued at very low levels. A light population was reported in wild balsam fir in Washburn County.

Balsam Twig Aphid - Mindarus abietinus (Koch)

Heavy populations damaged balsam fir Christmas trees in Dane, Langlade, Marinette, Marquette, Lincoln and Marathon counties. Damage to spruce was reported in Dane County.

Balsam Fir Sawfly - Neodiprion abietis (Harris)

A heavy population defoliated balsam fir Christmas trees in Kewaunee County (NENW, Section 23, T25N, R25E). The grower sprayed with Malathion.

Winter Injury

Late winter alternating warm and cold temperatures apparently reduced the cold hardiness of balsam fir Christmas tree buds in Marquette, Waushara and Marinette counties. The injury was indicated by the failure of buds to produce new growth or delayed and stunted shoot growth.

Injury varied greatly from tree to tree. In some locations, unaffected trees were adjacent to severely injured trees that had lost all buds except those within one foot of the ground (and presumably protected by snow). Some trees had scattered buds affected while others had only the south facing buds affected. The delayed shoot growth was usually one to two inches long. This phenomenon was observed only on trees that had been sheared in 1986.

BASSWOOD

Basswood Thrips - Sericothrips tiliae (Hood)

Defoliation of basswood increased in area and intensity in the northeastern counties for the second consecutive year. Heavy defoliation of pole and sawlog sized basswood occurred over a 200,000 acre area (Figure 4). Some mortality of pole sized trees occurred in Forest and Langlade counties. Some crown dieback and epicormic branching in all size classes occurred in Forest County. Scattered light to heavy defoliation of individual trees occurred in Door County.

Defoliation was very spotty in the northwestern counties where individual trees were completely defoliated near other trees with little or no defoliation. Several pockets of tree mortality and top dieback occurred in Rusk County

(Figure 4) where severe drought inhibited recovery from heavy defoliation. DNR Forest Pest Management and the Department of Entomology, University of Wisconsin - Madison, are planning to cooperate on an impact survey that will begin in 1988.

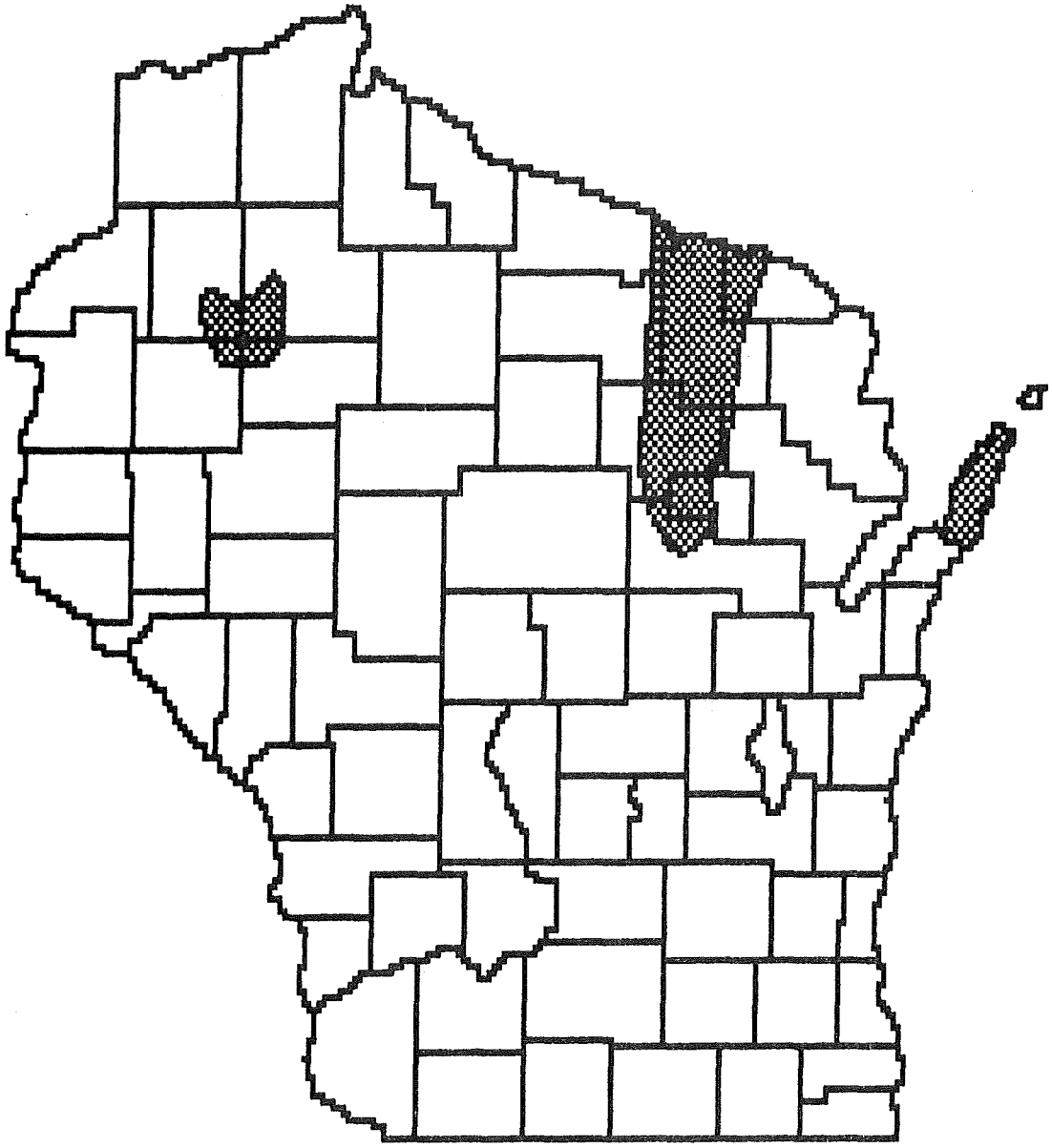


Figure 4. Area of defoliation in Northern Wisconsin caused by Basswood Thrips - 1987.

Premature Leaf Drop of Basswood

A large area of basswood in Bayfield and Sawyer counties exhibited premature leaf drop presumably caused by severe drought (see weather map, Figure 5). The area had not been defoliated by Basswood Thrips.

BIRCH

Birch Leafminer - Fenusa pusilla (Lepeletier)

Reports of leafminer damage were received from Fond du Lac, Jackson and Langlade counties. Damage was heavy in ornamental and wild white birch in Washburn, Burnett and Sawyer counties. Heavy populations were reported on ornamentals in Milwaukee County.

Premature Leaf Drop - Drought

Many white birch exhibited premature leaf drop due to drought in Northwestern Wisconsin (Figure 5).

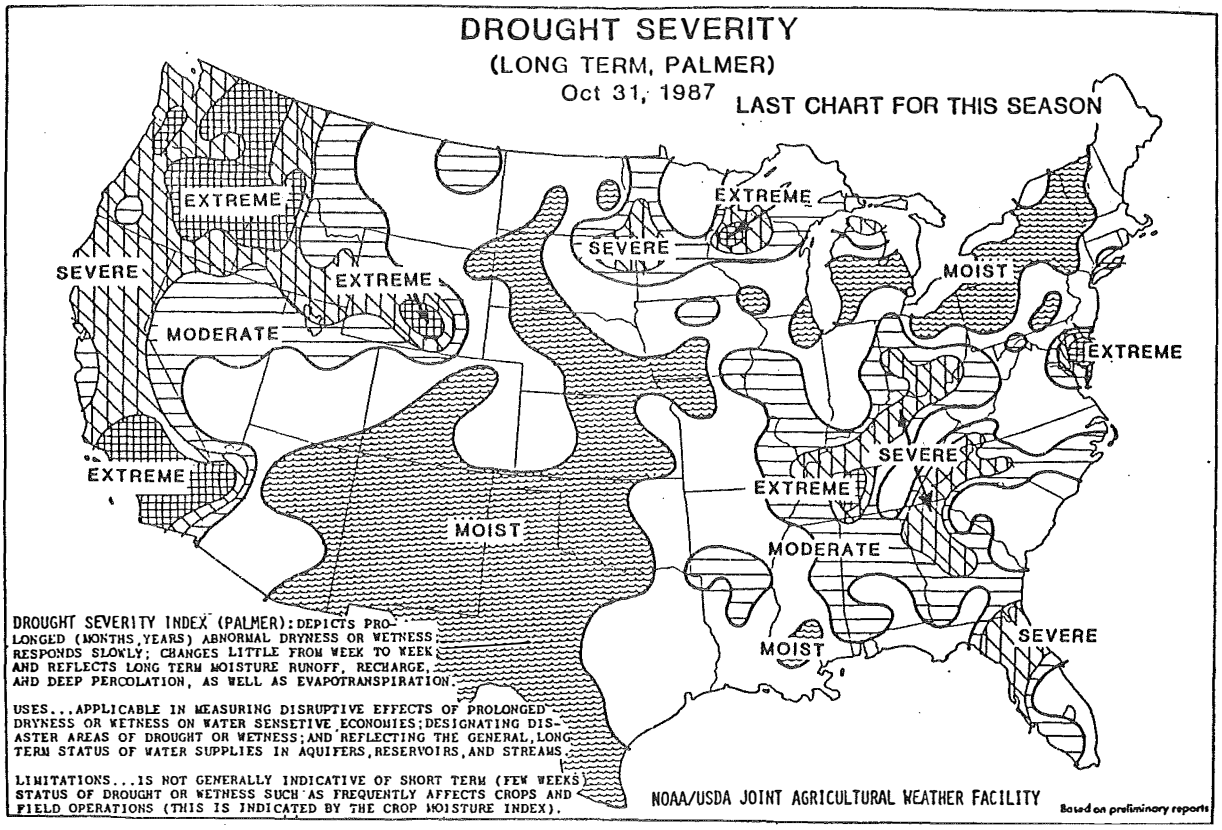

DROUGHT SEVERITY
(LONG TERM, PALMER)
Oct 31, 1987
LAST CHART FOR THIS SEASON
EXTREME
SEVERE
EXTREME
MODERATE
EXTREME
MOIST
EXTREME
SEVERE
MOIST
EXTREME
SEVERE
MOIST
MODERATE
EXTREME
SEVERE
DROUGHT SEVERITY INDEX (PALMER): DEPICTS PRO-LONGED (MONTHS, YEARS) ABNORMAL DRYNESS OR WETNESS RESPONDS SLOWLY; CHANGES LITTLE FROM WEEK TO WEEK AND REFLECTS LONG TERM MOISTURE RUNOFF, RECHARGE, AND DEEP PERCOLATION, AS WELL AS EVAPOTRANSPIRATION.
USES...APPLICABLE IN MEASURING DISRUPTIVE EFFECTS OF PROLONGED DRYNESS OR WETNESS ON WATER SENSETIVE ECONOMIES; DESIGNATING DIS-ASTER AREAS OF DROUGHT OR WETNESS; AND REFLECTING THE GENERAL, LONG-TERM STATUS OF WATER SUPPLIES IN AQUIFERS, RESERVOIRS, AND STREAMS.
LIMITATIONS...IS NOT GENERALLY INDICATIVE OF SHORT TERM (FEW WEEKS) STATUS OF DROUGHT OR WETNESS SUCH AS FREQUENTLY AFFECTS CROPS AND FIELD OPERATIONS (THIS IS INDICATED BY THE CROP MOISTURE INDEX).
NOAA/USDA JOINT AGRICULTURAL WEATHER FACILITY
Based on preliminary reports

Figure 5. Drought severity (long term, Palmer) showing extreme and severe conditions for Northwestern Wisconsin. Taken from the U.S. Department of Commerce and U.S. Department of Agriculture Weekly Weather and Crop Bulletin, 1987, Vol. 74, No. 44.

Yellow Birch Dieback - Unknown

Top dying of yellow birch in Northern Wisconsin was first observed in 1984. Since then, dieback and mortality has occurred in Rusk, Saywer, Florence and Menominee counties (Figure 6).

In 1987, an early summer drought continued to stress the yellow birch on the Flambeau River State Forest in Saywer County. Approximately 110 acres of yellow birch - hemlock forest were salvage logged on the Flambeau River State Forest in 1987 because of the dieback. Sawlog-sized yellow birch continued to die back and pole-sized birch appeared not to improve or decline.

In Menominee County, where dieback and mortality has been light, crown leaf area increased on most trees. The marking crews encountered an occasional dead tree in the sawlog-veneer class. Sawlog and small pole-sized trees had well developed leaf surface area.

In Florence County, feeding by an unidentified early summer defoliator, early summer drought, and a heavy seed crop caused severe dieback (>75% of crown dead) and mortality in the sawlog-veneer class. Incidence of dieback and mortality was light and scattered.

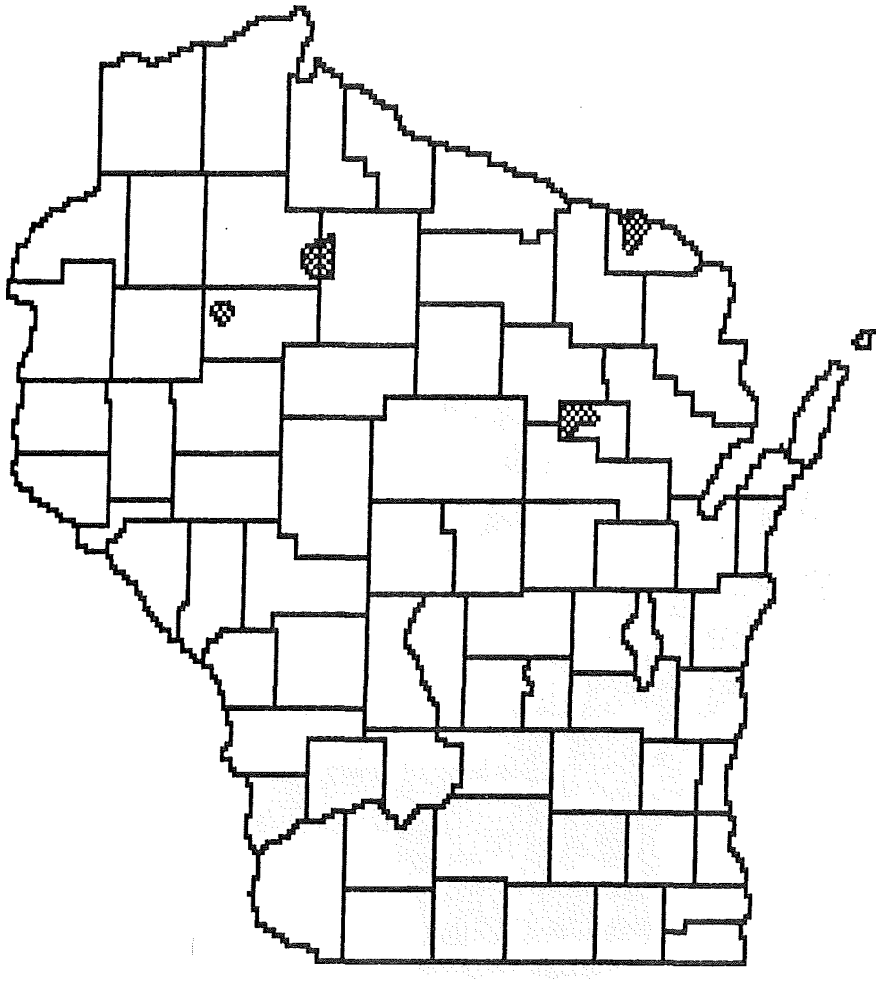


Figure 6. Area of Yellow Birch Dieback - 1987.

BUTTERNUT

Butternut Canker - Sirrococcus clavigignenti - juglandacearum Nair, Kostichka and Kuntz

Butternut canker was confirmed in Menominee County, Northeastern Wisconsin, in 1986 (Figure 7). In 1987, the USDA Forest Service and Wisconsin DNR conducted a survey to determine the distribution and incidence of butternut canker in Menominee County. To determine distribution, fourteen timber management compartments totalling 13,740 acres in Menominee County were surveyed for the presence of butternut canker (Figure 8). To determine incidence, three, two acre plots were examined in each of six compartments with butternut canker. The diameter, presence or absence of cankers, and health status (dead or alive) were recorded for each butternut in the incidence plots.
Results of the survey were:

1) Butternut canker was observed in 11 out of 14 of the compartments surveyed. No butternut trees or cankers were found in 3 of the compartments.

2) Butternut canker was present on 81% (87/107) of the trees surveyed.

3) All size classes, dbh of 5-11", 11.1-15", and greater than 15", were infected.

4) Butternut canker has been present in Menominee County for at least 5 years.

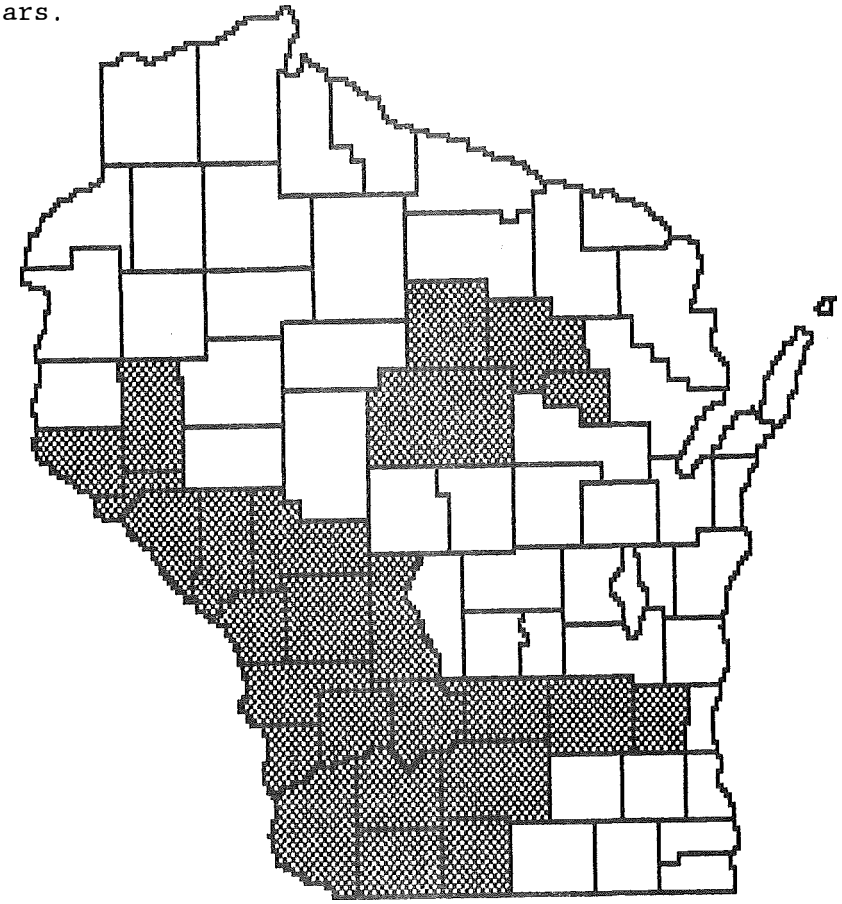
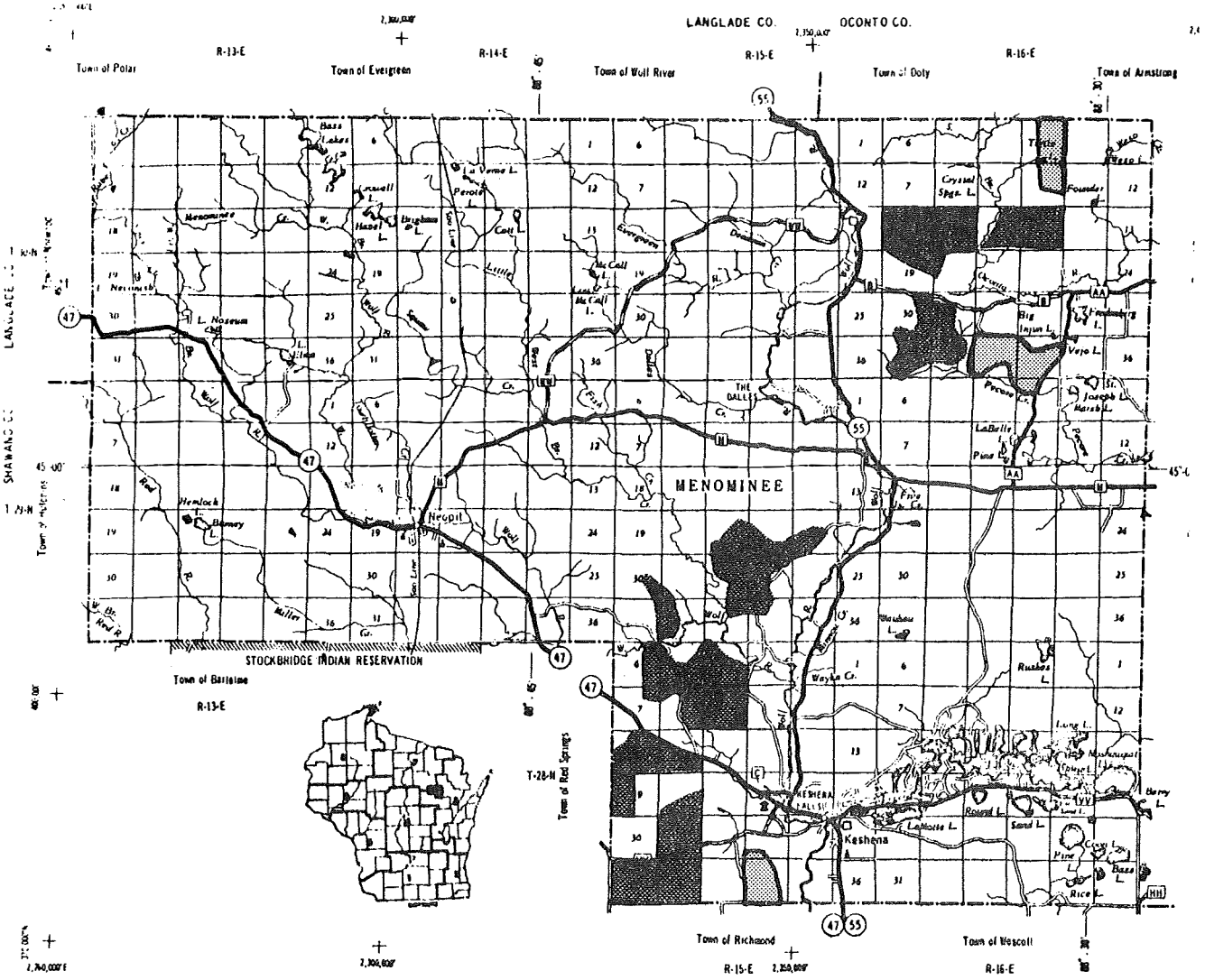


Figure 7. Known county distribution of Butternut Canker - 1987.



Compartments with no Butternut Canker.

Compartments with Butternut Canker.

Figure 8. Timber management compartments surveyed for Butternut Canker - 1987.

Table 1. Number and percent of butternut trees cankered in six timber management compartments.

Compartment	Butternut trees (no.)	Cankered (no.)	(%)	Cankered
106	15	7		47
110	5	1		20
215	39	37		95
224	12	11		92
231	16	12	75	
232	20	19	95	
TOTAL	107	87		81

Table 2. Number and percent of cankered butternut trees in three size classes.

Size class (dbh)	Butternut trees (no.)	Cankered (no.)	(%)	Cankered
5-11"	60	57		95
11.1-15"	20	10	50	
>15"	27	20	74	
TOTAL	107	87	81	

CHERRY

Eastern Tent Caterpillar - Malacosoma americanum (Fabricius)

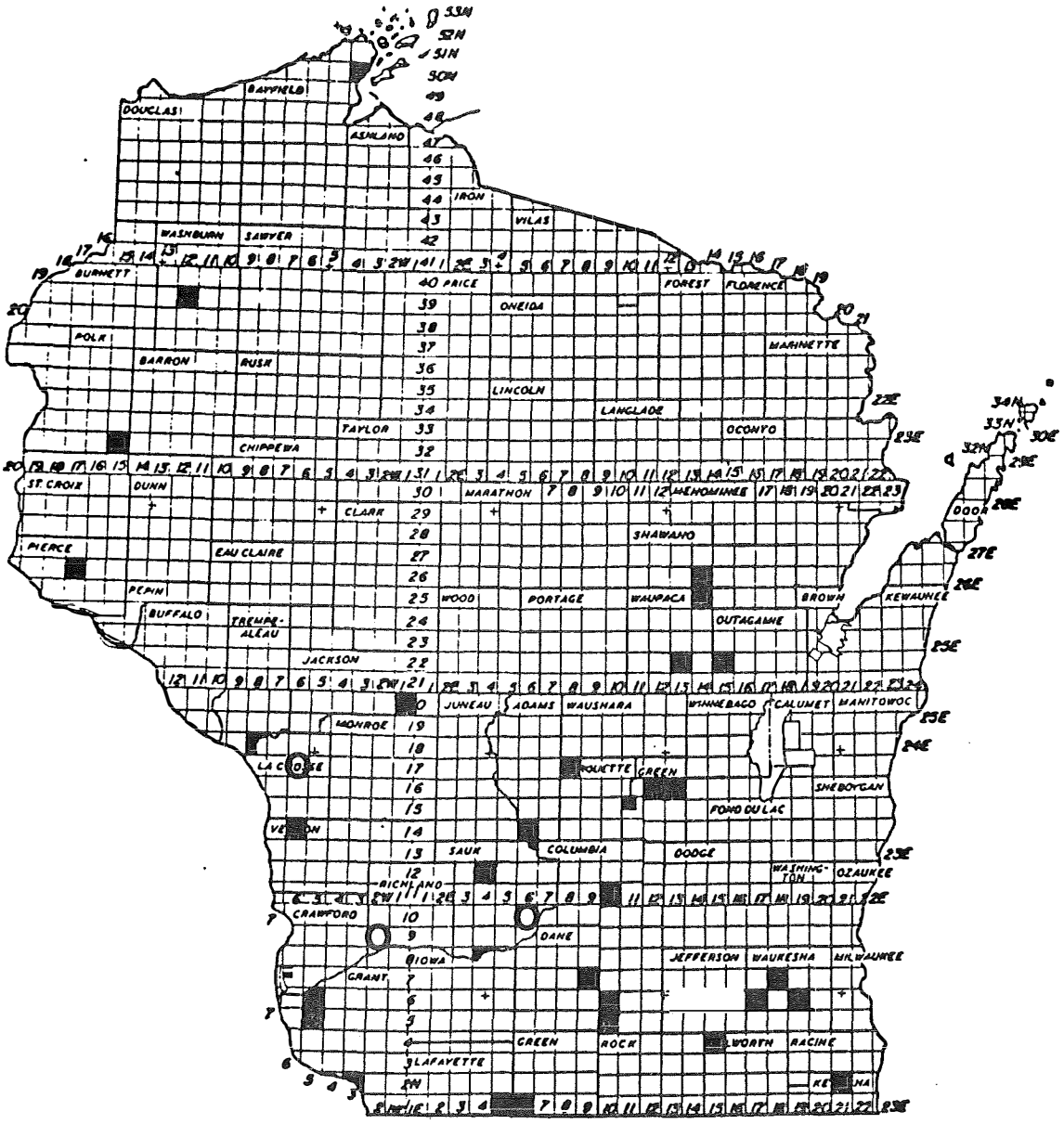
The numbers of tents on fence row and road side black cherry were high statewide. But the numbers were "incredibly high" in many areas of Dane, Rock, Green and Iowa counties.

In the northwestern counties, the defoliation was confined almost exclusively to choke cherry.

CHESTNUT

Chestnut Blight - Endothia parasitica (Murrill) Anderson and Anderson

Chestnut blight was first reported in Wisconsin in 1986 in Richland and Sauk counties, Southwestern Wisconsin. In 1987, chestnut blight was observed in LaCrosse County (Section 14, T17N, R6W) (Figure 9). The chestnuts were scattered throughout a 60 acre mixed hardwood stand with oak and ash as the predominant species. This stand developed through natural seed dispersal from several trees planted over 80 years ago by a farmer.



Chestnut locations. ■

Chestnut Blight locations. O

Figure 9. Township locations of Chestnut and Chestnut Blight - 1987.

Four trees were found to be infected with the blight and a description follows:

Tree #	Height	Diameter	Description
1	60′	16"	Dead tree with triple top. Multiple cankers with imperfect stage fruiting abundantly.
2	55′	18"	Live tree with two large seams. One small (6") canker near the base. No fruiting observed.
3	38′	5"	Live tree, double stem with swollen base. One small (3") canker at the base. Imperfect fruiting state observed.
4	43′	9"	Live tree, double stem. Small (3") canker at the base. Imperfect fruiting stage observed.

Eradication was attempted by spraying trees #1-3 with a protein base fire retardant foam to inhibit spore dispersal during felling. The trees were cut and placed in a four foot deep trench and covered with soil. The foam is normally used to control fires and to prevent trees and structures from catching on fire. The base of tree #4 was mounded with top soil above its basal canker to inhibit growth of the canker. This site will be surveyed annually for the presence of new infections.

Isolates from all three chestnut blight locations in Wisconsin were sent to Dr. William McDonald, West Virginia University, to be analyzed for vegetative compatibility. The LaCrosse isolates were of one vegetative compatibility type and the Sauk and Richland county isolates were of a different type. The LaCrosse isolates were not vegetatively compatible with the Sauk and Richland county isolates (Table 3). Therefore, there are two known vegetatively compatible types in Wisconsin. Work in 1988 will concentrate on checking more isolates for the presence of different compatibility types and looking for the perithecial stage of Endothia at the Richland County site.
The five infected trees at the Sauk County site were cut for lumber during the fall of 1987.

Table 3. Compatability of Endothia parasitica isolates from three counties in Wisconsin.

Counties	LaCrosse	Sauk	Richland
LaCrosse	+	-	-
Richland	-	+	+
Sauk	-	+	+

+ = compatible
- = incompatible

CHRISTMAS TREES

Cyclaneusma Needlecast - Cyclaneusma minus (Butin) DiCosmo, Peredo and Minter

Cyclaneusma needlecast has been reported frequently from Scotch pine Christmas tree growers in Central Wisconsin. To determine the best fungicidal spray control for Cyclaneusma needlecast, the U.S. Forest Service, North Central Forest Experiment Station, initiated a study in 1986 to look at the control value of four fungicides. Fungicide trials were designed to determine the effectiveness of various concentrations and application timings of the fungicides Bravo 500 (chlorothalonil), Bravo W-75, Dithane M-45 (mancozeb), and Benlate (benomyl). The treatments were applied with back-pack mist blowers to a Christmas tree plantation in Waushara County in 1986, repeated in 1987, and will be repeated and evaluated in 1988.

A study to determine the effect of aerially applied fungicide sprays of Bravo 500 on incidence and severity of winter injury on Scotch pine was also initiated by the U.S. Forest Service, North Central Forest Experiment Station in 1986. Sprays were repeated in 1987 and will be evaluated in 1988.

Winter Injury

Balsam Fir - see Balsam Fir section

Scotch Pine

Reports were frequent from Central Wisconsin of mortality of Scotch pine seedlings planted within the last two years. Up to 20% of the seedlings died in some Christmas tree plantations from the lack of snow cover and drying winds. The heaviest mortality was present in areas where there were no windbreaks and seedlings were exposed to the wind.

White Pine Blister Rust - Cronartium ribicola Fisch.

Reports of high incidence of white pine blister rust were frequent from Christmas tree growers in Southern Wisconsin.

Pine Gall Rust - Cronartium quercuum (Berk.) Miyabe ex Shirai f. sp. banksianae Burdsall & Snow or Endocronartium harknessii (J. P. Moore) Y. Hiratsuka

Reports of the presence of galls on Scotch pine branches were frequent from Central and Southern Wisconsin. Most galls were on 1984 stem and branch tissue. Galls from two large infestations will be speciated in 1988.

Needlecast of Douglas Fir

Douglas fir yard trees at a home in Marinette County, and Douglas fir Christmas trees in Kewaunee County showed symptoms of needlecast in May. The causal organism has been tentatively identified as Rhizosphaera kalkhoffii. Further work to confirm the diagnosis will be done in 1988 since Douglas fir would be a newly reported host for Rhizosphaera in Wisconsin.

LARCH

Larch Needlecast - Mycosphaerella laricina (Hartig) Neg.

Four new counties were added to the known distribution of larch needlecast on European larch in Wisconsin (Figure 10). New locations were detected in Dane, Green, Sauk, and Vilas counties. In Green County, Southern Wisconsin, approximately 75 trees are infected in a four year old plantation (Section 13, T4N, R7E). In Sauk County, Southern Wisconsin, infected trees are located in Section 4, T10N, R7E. In Vilas County, North-central Wisconsin, one tree is infected on the grounds of the Department of Natural Resources Headquarters at Trout Lake (Section 8, T41N, R7E).

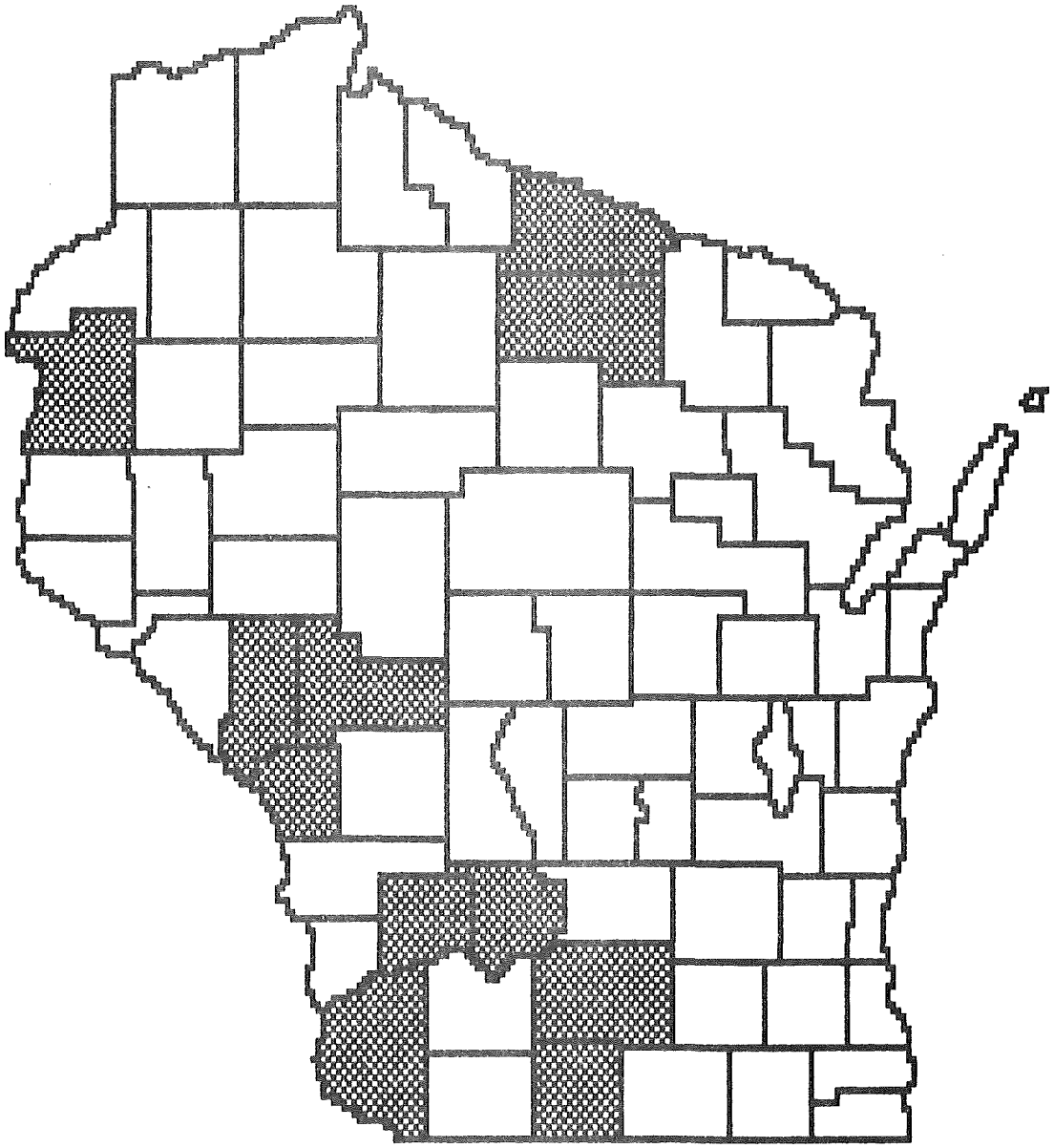


Figure 10. Known county distribution of Larch Needlecast caused by Mycosphaerella laricina - 1987.

In Dane County, approximately eight trees were moderately to severely defoliated in an eight year old plantation. Approximately 500 European larch trees are mixed with white ash and white pine in this infected plantation.

Defoliation of twenty-two year old European larch on the Coulee Experimental Forest, LaCrosse County, West-central Wisconsin, was heavy and occurred in late August.

Approximately 85% of the trees were defoliated in a 10 acre Polk County plantation, (Town of Lorraine, Section 32, T37N, R15W). Defoliation has occurred at this location since 1981.

The three Wisconsin state forest tree nurseries were surveyed for the presence of this disease and none was detected on the larch seedlings.

In 1982, researchers from the U.S. Forest Service, North Central Forest Experiment Station, initiated a study to determine the host range of Mycosphaerella laricina. Larch species and hybrids of larch were planted adjacent to an infested plantation on the Coulee Experimental Forest in La Crosse County. In 1987, disease was severe (76-100% defoliation) on European larch, high (51-75% defoliation) on tamarack, and at a trace level on Japanese larch. Even though the tamarack seedlings were defoliated, this disease has not been observed in natural stands of tamarack.

Within the same study, larch from various seed sources were evaluated for their resistance to Mycosphaerella. Variability was observed in disease resistance among European larch and hybrid larch seed sources. Detailed results of this study are being prepared for publication.

Larch Needlecast - Meria laricis Vuill.

Meria laricis is a new disease in Wisconsin and has been previously reported in the states of Washington, Idaho, Montana, and the Canadian provinces of British Columbia, Alberta, and Ontario. This disease was first detected at the Hayward State Nursery, Saywer County, on two year old European larch seedlings. Approximately 20,000 seedlings were infected and lightly defoliated. Symptoms of brown needle tips and light defoliation occurred in mid-June through August. The Wisconsin Department of Agriculture Trade and Consumer Protection ordered destruction of the stock. A survey of 18 European larch plantings revealed two additional locations of Meria laricis (Figure 11). In Polk County, the disease was confirmed from one seedling that had seeded in from trees in a 19 year old windbreak (Section 28, T37N, R16W). In Wood County, (Section 4, T22N, R6E), four, 30 to 40 year old trees, all within 500 yards of one another were infected. These trees are on three separate private properties. Each tree had a trace amount of defoliation.

A survey to determine the distribution of Meria laricis in European larch plantations is planned for 1988.

Larch Sawfly - Pristiphora erichsonii (Hartig)

Populations remained generally low in Wisconsin. Reports of light defoliation were received from Jackson County and the northwestern counties. Moderate to heavy defoliation of European larch occurred for the second year in an isolated 1/2 acre plantation in Clark County.

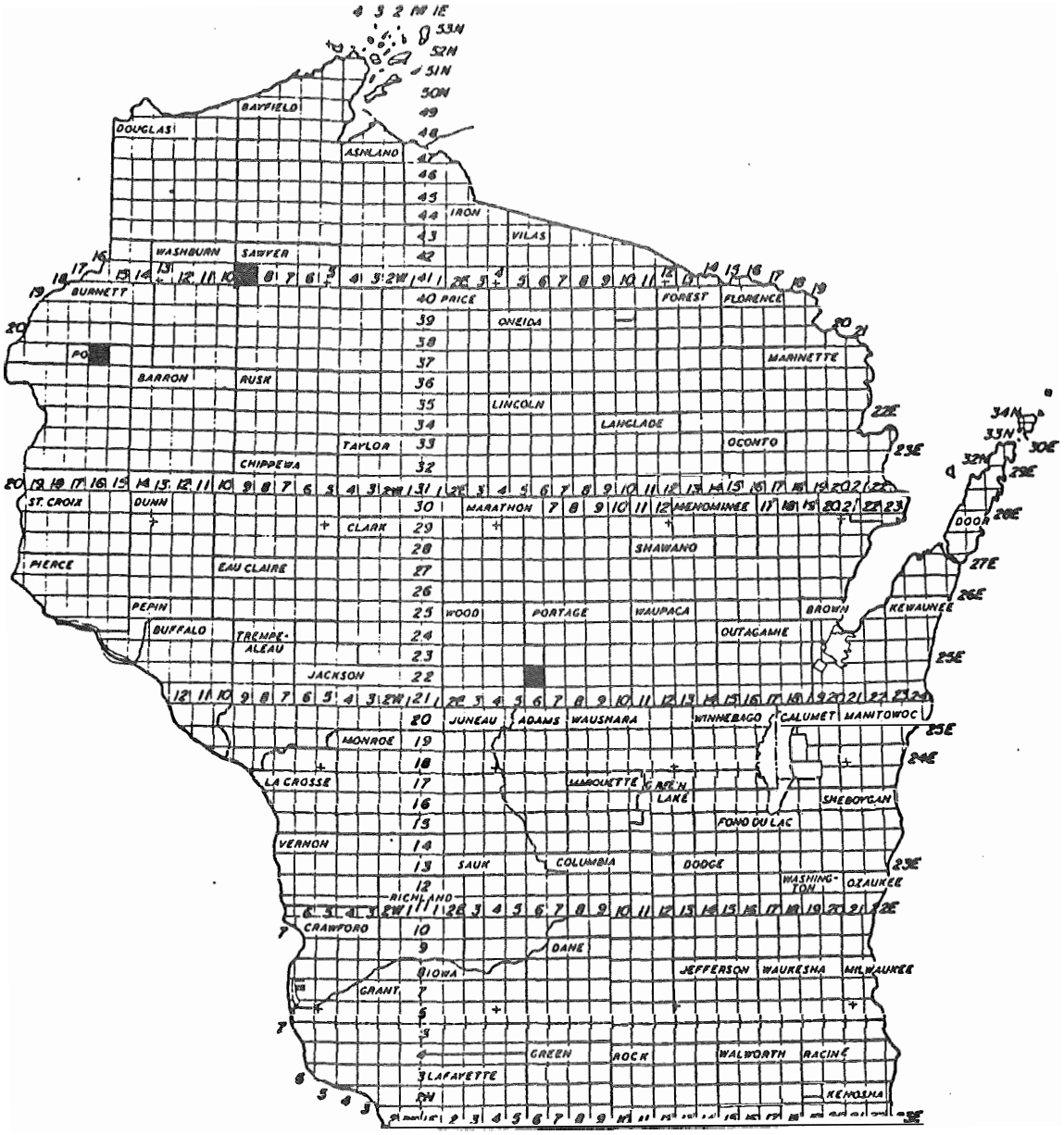


Figure 11. Known township locations of Larch Needlecast caused by Meria laricis - 1987.

MAPLE

Bruce Spanworm - Operophtera bruceata (Hulst)

Populations declined in the northwestern counties where no defoliation was observed.

The northeastern population appears to be collapsing. Scattered pockets of light defoliation of sugar maple occurred over a large area (Figure 12). About 35,000 acres of moderate to heavy defoliation occurred in Forest and Florence counties where moth flight last fall was extremely heavy.

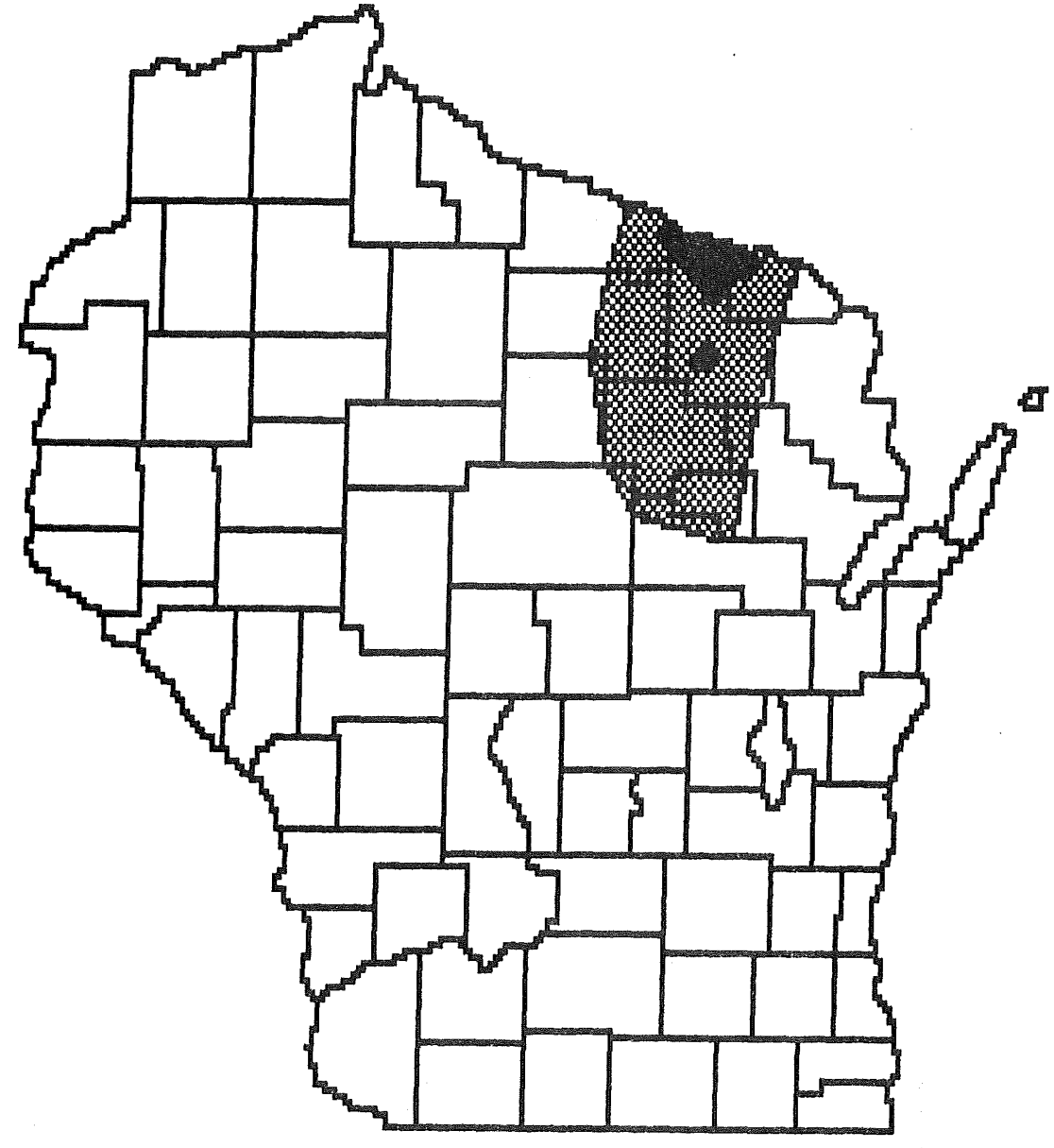


Figure 12. Area of defoliation caused by the Bruce Spanworm - 1987.

Maple Petiole Borer - Caulocampus acericaulis (MacGillivray)

Moderate defoliation was reported on sugar maple in Western Richland County.

Sapstreak - Ceratocystis coerulescens (Munch)

Sapstreak disease of sugar maple has been observed in Forest and Menominee counties. Infection may occur through basal wounds, which are common along logging roads. The U S Forest Service, State & Private Forestry conducted a survey to determine the incidence of sapstreak along logging roads in Menominee County, and to see whether there was a difference in the incidence of sapstreak in stands logged during frozen versus non-frozen conditions. Logging during periods of wet weather when the ground is not frozen causes deep rutting of skid trails, soil compaction and injury to tree roots.

Results reported here were taken from a report in press entitled "Influence of Logging Season and Wounds on the Incidence of Sapstreak Disease of Sugar Maple in Menominee County, Wisconsin", by Manfred E. Mielke and David A. Charette, USDA Forest Service, Forest Pest Management, St. Paul, MN. The survey showed that there was an average of 0.89 wounded sugar maple per chain of logging road and that 5.3% of the wounded trees along logging roads were infected with sapstreak disease. Time of logging had no significant effect on the numbers of wounds per tree, wound surface area, or the incidence of sapstreak. Assuming infection rates to be lower in trees away from the logging roads, these results indicate the impact of sapstreak disease in Menominee County is negligible.

Sugar Maple Decline - Unknown

A two year survey to detect sugar maple decline and mortality in Northern Wisconsin was initiated. The survey was a cooperative project between the USDA Forest Service, DNR Forest Pest Management, and the DNR Acid Rain Section. Sugar maple is the most prevalent species on 4 million acres of northern hardwood forests throughout Northern Wisconsin. The DNR has determined through wet deposition monitoring at six sites, that a rain pH gradient exists over the range of sugar maple in Wisconsin. The gradient consists of four pH zones. The presence of sugar maple across this observed pH gradient gives an opportunity to achieve the following objectives:

1) Determine if there is a difference in the number, volume, and basal area per acre of healthy, dead and declining sugar maple and associated hardwoods between pH zones.

2) Determine the total number, volume, and basal area per acre of healthy, dead and declining sugar maples and associated hardwoods in Northern Wisconsin.

3) Determine the acres of sugar maple decline and mortality in four damage classes (no damage, light, moderate and heavy) based on the number of dead and declining sugar maples in a 2.5 acre plot.

4) Determine the amount of decline and mortality associated with known insect and disease pests.

The objectives will be reached by taking color infrared photo plots, using photo interpretation to collect information on decline and mortality, then checking and supplementing the data with ground plots. One hundred and ninety photo

plots (a strip of five 9 X 9 photos with 70% overlap) were taken in 1987 at a scale of 1:8,000. The photo interpretation will be finished by June of 1988, and the ground plots visited during the summer of 1988.

Sugar Maple Decline in Sugar Bushes - Unknown

A survey to determine the incidence, severity, and possible causes of dieback and decline in sugar bushes in Wisconsin was initiated in 1987. Five one-fifth-acre fixed-radius plots were established in each of 42 sugar bushes. The health of sugar maples with a diameter at breast height (dbh) greater than or equal to five inches was evaluated. Trees in plots were examined during the period between 15 June and 22 August and once again between 24 August and 30 September. Percent twig and branch dieback, crown vigor, condition of the trunk and root collar, and presence of diseases and insect pests were noted and the crown class and dbh of each tree were determined. A decline severity index, based on a 0-100% scale, for each plot was determined from individual crown-health ratings. The general condition of each sugar bush also was assessed. Approximately 95% of 3140 dominant-codominant sugar maples examined had healthy crowns. Of the 42 sugar bushes examined, 13, 22, 6, and 1, respectively, were rated Excellent (overall stand healthy), Good (some dieback but ont alarming), Fair (obvious dieback, a potential problem), and Poor (serious dieback and death of trees) (Figure 13). Results from this study indicate that, at present, there is not a widespread maple dieback problem in Wisconsin sugar bushes. In 1988, 15 of the 42 sugar bushes will be resurveyed for dieback and decline and classified as to vegetation habitat type. A DNR technical report on this project is currently in press.

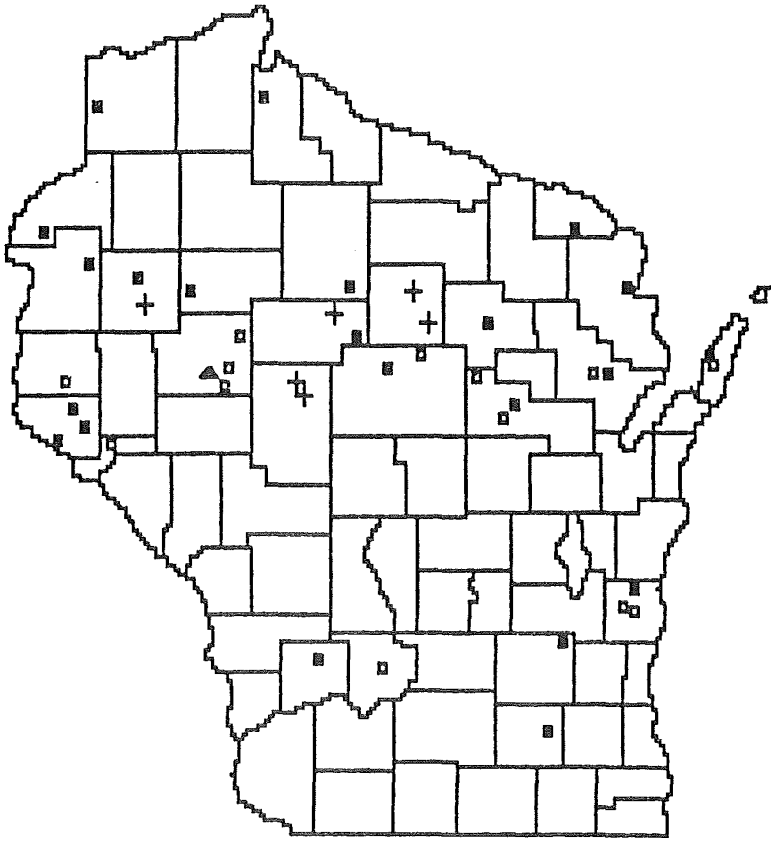


Figure 13. General condition of sugar bushes included in 1987 sugar maple insect and disease survey. Sugar bush health was categorized as being excellent (open square), good (closed square), fair (plus sign), or poor (triangle).

NURSERY

Larch Needlecast - Mycosphaerella laricina (Hartig) Neg.
Meria laricis Vuill.

See Larch pests.

White Pine Root Rot - Unknown

Workers at the Griffith and Wilson State Forest Tree Nurseries were trained to sort root rotted from healthy white pine during the lifting and packaging season. Approximately 40% (80,000) of the sorted 3-0 and transplant white pine were culled at Griffith Nursery. At Wilson Nursery, some beds were not even lifted because of the high incidence of root rot. The total loss of 3-0 white pine at Wilson Nursery, including unused beds and seedlings culled from root rot, size and lifting damage was 64% (480,000) of the 3-0 white pine inventory.

All three Wisconsin State forest tree nurseries were sampled for the presence of root rotting pathogens three times (June, July and August) during the summer by DNR and U S Forest Service pathologists. A variety of pathogenic and nonpathogenic fungi were isolated. Isolates are being stored for possible pathogenicity tests.

A white pine survival study was established at the Griffith Nursery to evaluate the effectiveness of sorting root rotted from healthy seedlings. See Appendix A for results of this study.

White Pine Needle and Shoot Blight - Pestalotiopsis sp.

In July and August, needle discoloration, top dieback, and sunken lesions appeard on the 2-0 white pine at the Wilson Nursery. Small patches of affected seedlings were scattered throughout the 2-0 white pine beds. Isolations yielded the fungus Pestalotiopsis. This fungus is known to act either as a saprophyte or a weak pathogen on Pinus spp. and may cause a needle and shoot blight and sunken lesions. Work is currently underway to identify this fungus to species. Further work on the significance of Pestalotiopsis will continue in 1988 if symptoms are observed.

OAK

Actinopelte Leaf Spot - Actinopelte dryina (Saccf.) (Hoehn)

Light infections observed in Washburn, Burnett and Polk counties.

Oak Wilt - Ceratocystis fagacearum (Bretz) Hunt

Oak wilt continues to kill white, red and black oak throughout the southern two-thirds of Wisconsin (Figure 14). No new counties reported oak wilt in 1987.

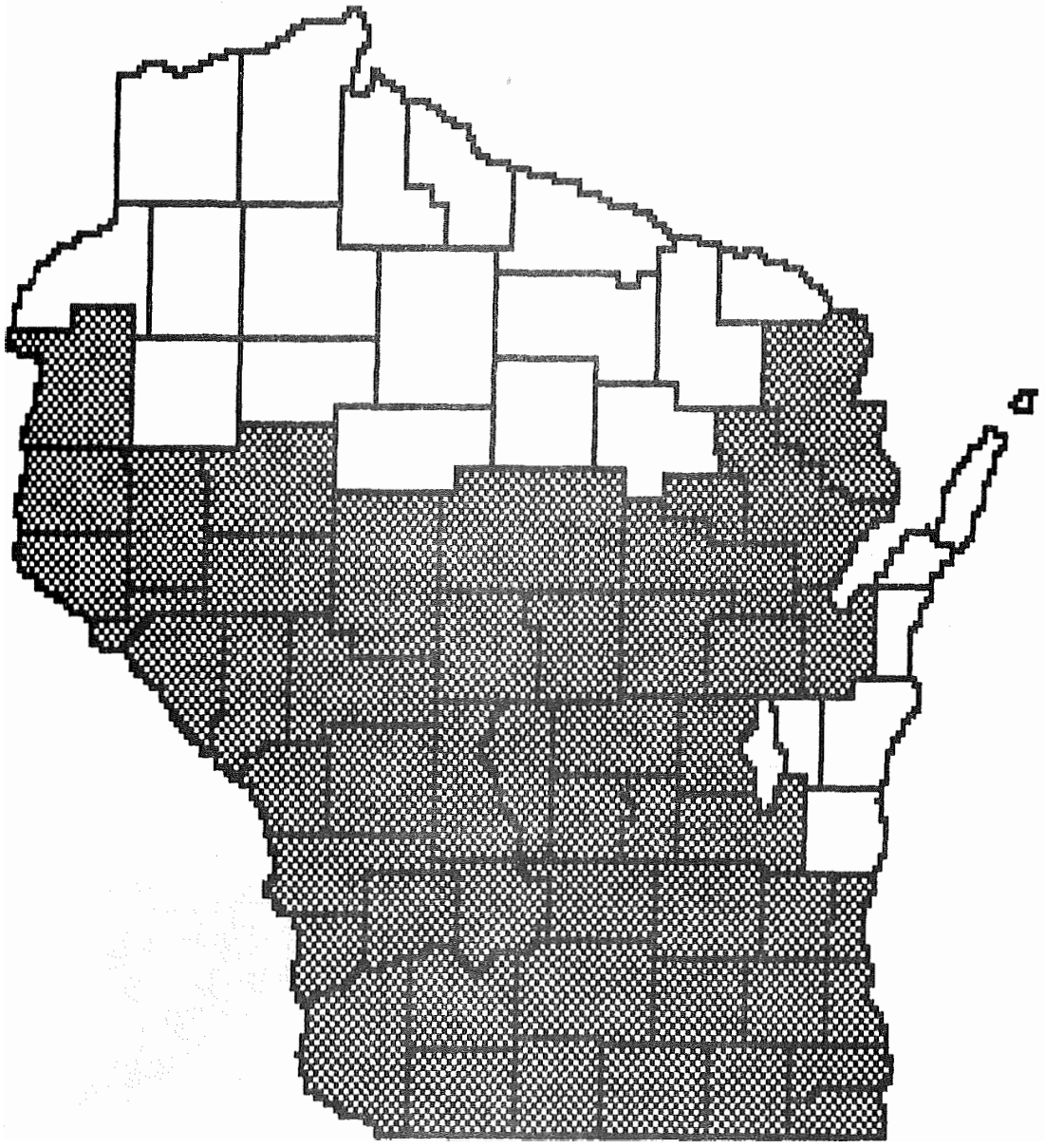


Figure 14. Known county distribution of Oak Wilt - 1987.

An aerial survey was conducted of Marinette, Shawano, Menominee, and Marathon counties. In Marinette County, 5 new pockets were observed along the eastern edge of the county, along the Menominee River (Figure 15). This brings the total number of pockets detected to 19. The DNR forester is cooperating with landowners by providing techinical assistance on control methods. Control is accomplished by trenching around pockets and/or removing and destroying infected trees.

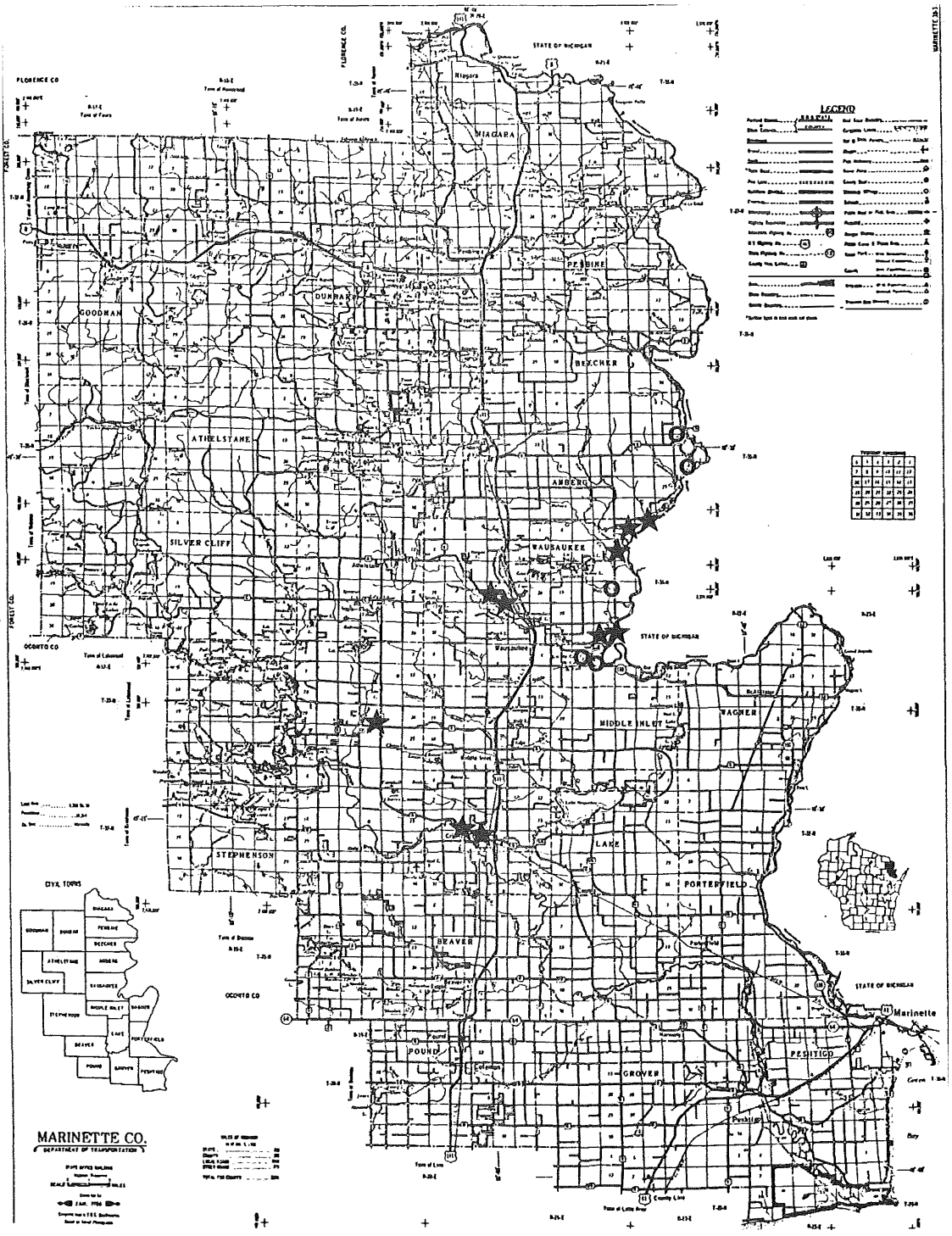


Figure 15. Locations of Oak Wilt pockets in Marinette County detected in 1987 (circle) and prior to 1987 (star).

In Shawano County, pockets continued to increase in size and number around Shawano Lake and Long Lake. In Menominee County, five new pockets were confirmed around Legend Lake. Three old pockets continued to spread despite trenching in previous years. All of these pockets have been either trenched or chemically treated and all trees within the plow lines have been removed and destroyed.

In Marathon County, two pockets were detected from the aerial survey. One pocket containing red and white oak is located in a woodlot on residential property in the SWNE of Section 1, T26N, R6E. The second pocket contains black oak and is in a 5 acre woodlot in the NENE of Section 1, T26N, R6E.

Fall Cankerworm - Alsophila pometaria (Harris)

The outbreak in the south-central counties rebounded after a sharp decline in 1986. Pockets of light defoliation of oaks occurred in Columbia County where extremely high numbers of predacious ground beetles were observed (Figure 16). The heaviest defoliation occurred on box elder and American elm. This is probably due to the very early, warm spring temperatures that caused larval emergence before the oak leaves developed.

Figure 16. Area of defoliation caused by the Fall Cankerworm - 1987.

Walkingstick - Diapheromera femorata (Say)

About 2000 acres of northern pin oak were completely defoliated in Oconto County (Figure 17). Heavy defoliation was reported on another 300 acres of oak in Jackson and Clark counties.

Phenological note:

August 5 - first adults observed in Jackson and Clark counties.

Figure 17. Area of defoliation caused by the Walkingstick - 1987.

Post Oak Locust - Dendrotettix quercus Packard

These grasshoppers caused noticeable defoliation of black and northern pin oak in Adams, Jackson and Monroe counties

Twolined Chestnut Borer - Agrilus bilineatus (Weber)

Oak mortality increased slightly in the area defoliated by cankerworms in 1987 in Columbia and Marquette counties.

Overstocking and drought combined to cause scattered pockets of red oak mortality in Winnebago, Outagamie and Calumet counties.

PINE

Drought

As a result of the severe drought in northwestern Wisconsin (Figure 5), many first year red pine plantings in Burnett and West-central Washburn counties experienced 40% or more mortality.

Physiological Red Pine Needle Droop - Drought

Current year's needles of red pine may droop if dry conditions occur during shoot and needle elongation. Needle droop was common in Northwestern Wisconsin in young red pine plantings in Douglas, Bayfield, and Washburn counties. Injury was severe as a majority of affected trees failed to produce healthy buds.

Red and Jack Pine Mortality - High Water in 1986

Over 1,000 acres of red and jack pine were killed by high water caused by heavy rainfall in 1985 and 1986 in Burnett County. Approximatley 80% of the mortality occurred to jack pine in West Marshland Township (Section 34, T39N, R19W) and in Grantburg Township (Section 3, T38N, R19W). Twenty percent of the mortality occurred to red pine in Anderson Township (Section 18, T37N, R19W).

Diplodia Canker and Shoot Blight - Sphaeropsis sapinea (Fr.) Dyke and Sutton

In 1984, Diplodia canker and shoot blight was scattered throughout red and jack pine plantations and natural stands in Douglas County in Northwestern Wisconsin. In 1987, trees that had previously been infected with Diplodia canker continued to decline as the cankers progressed. New infections have been rare since the 1984 outbreak.

Diplodia shoot blight was also observed occasionally on red pine injured by frost, spittlebug, and needle droop in Northwestern Wisconsin.

Scleroderris Canker - Ascocalyx abietina (Naumov) (Schlaepfer-Bernhard)

No new locations of Scleroderris Canker were observed in 1987 (Figure 18). A survey was conducted at two locations (Douglas and Bayfield counties) where Scleroderris canker had been newly reported in 1986.

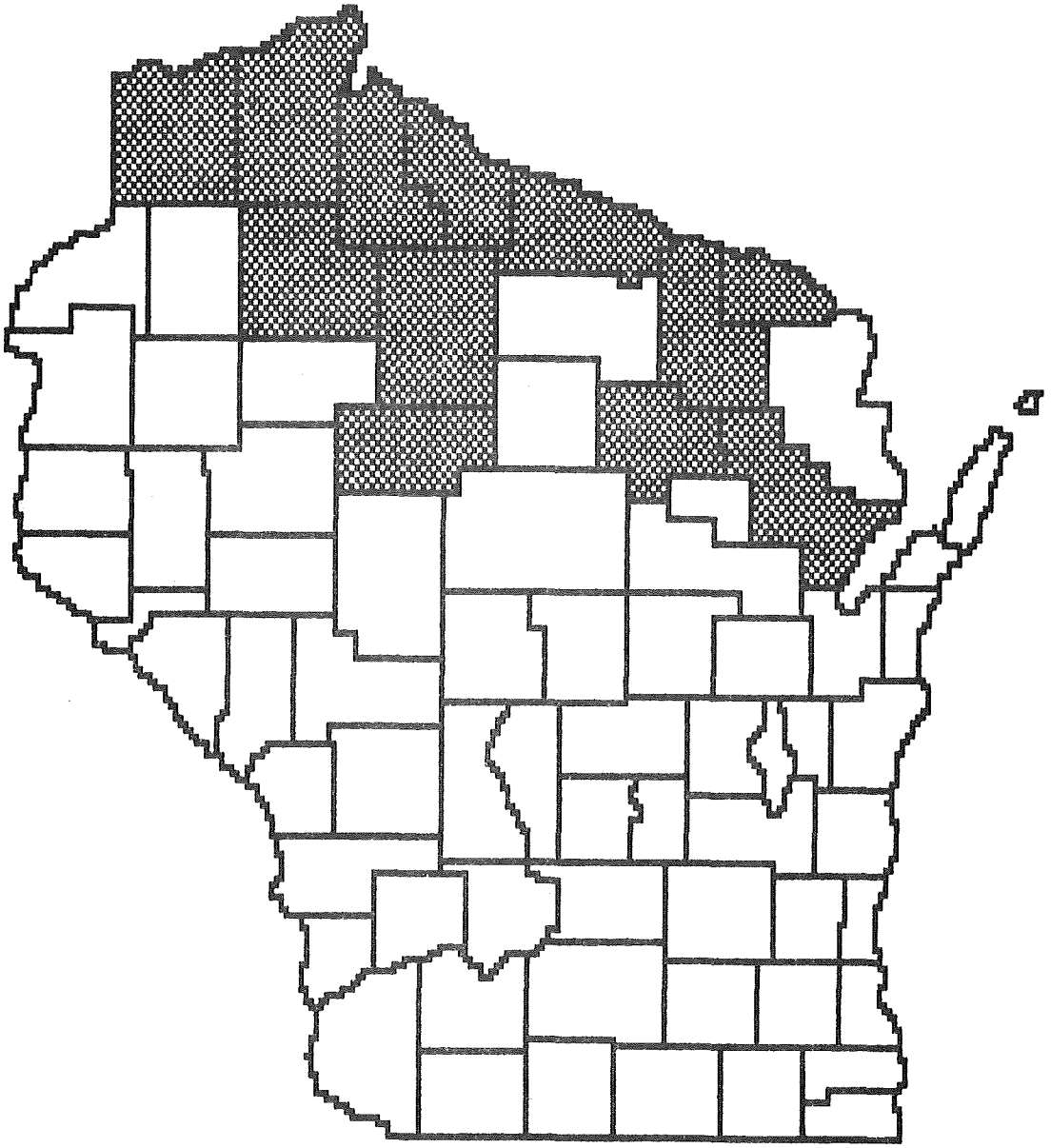


Figure 18. Known county distribution of Scleroderris Canker - 1987.

The Douglas County location (SWSW of Section 23, T45N, R10W), is a nine year old, 40 acre plantation in Highland Township on industrial forest land. Ten plots of 100 trees each were examined for the presence of Scleroderris canker and shoot blight. Five of the plots were within a frost pocket, five outside of the frost pocket on higher ground. There were no infected trees in plots outside of the frost pocket, and 3/500 or 0.6% of the trees in the frost pocket were infected.

The Bayfield County location (Section 3, T45N, R9W), is a 13 year old 640 acre plantation in Barnes Township on county forest land. Thirty plots of 100 trees each were examined for the presence of Scleroderris canker and shoot blight. Twenty of the plots were within frost pockets, ten outside of frost pockets on higher ground. There were no current infections on trees in plots outside of the frost pockets, and 129/2000 or 6.45% of the trees in the frost pockets were infected. This stand also had a high incidence of physiological needle droop in some of the frost pockets, and heavy damage from spittlebug.

Red Pine Shoot Blight - Sirococcus strobilinus (Pruess)

No new counties reported this disease in 1987 (Figure 19). In Vilas County, understory red pine along Co. Hwys M and K had shoot blight symptoms, drooping necrotic current year's needles. These symptoms were scattered on infected trees over approximately 400 acres.

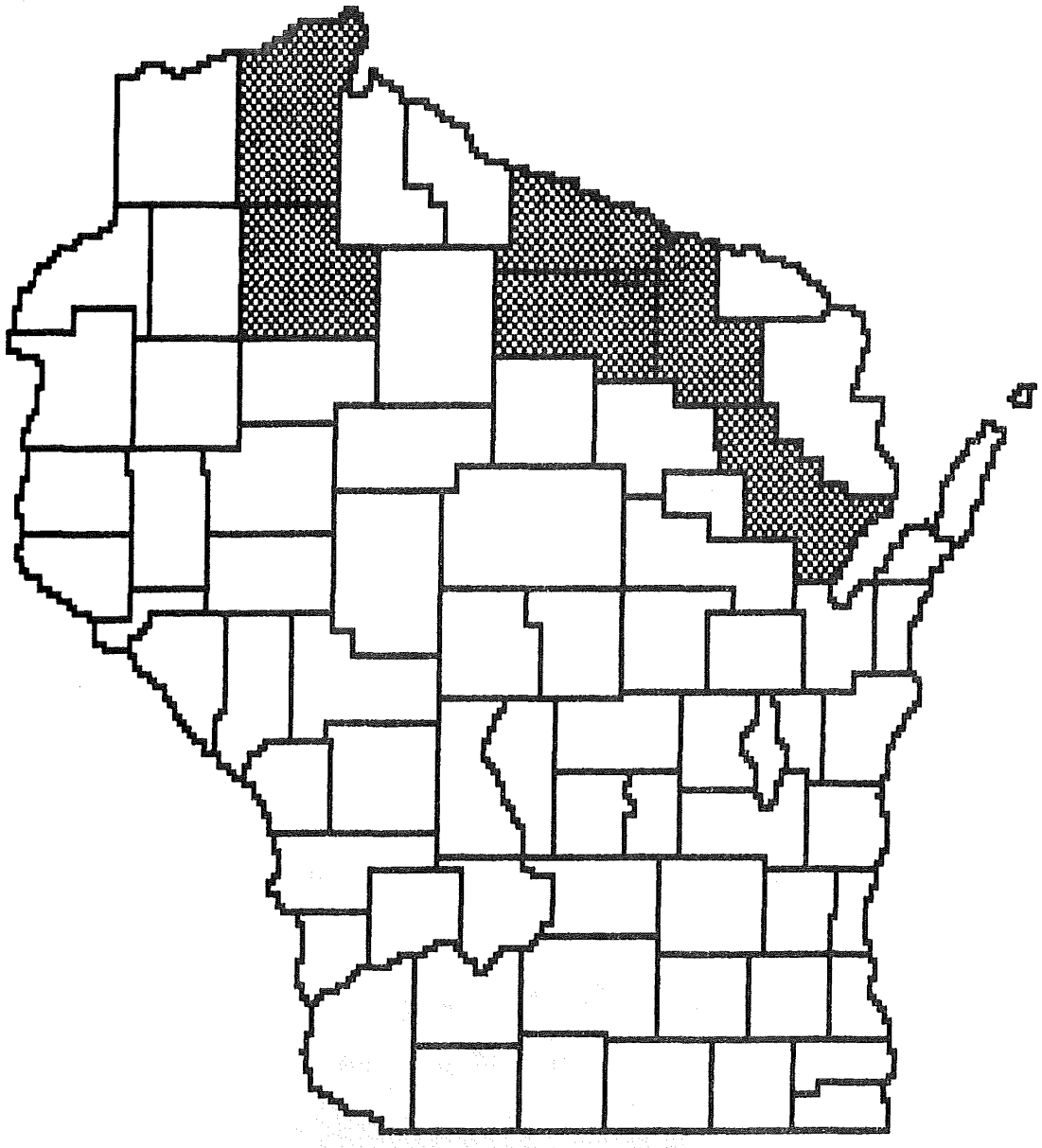


Figure 19. Known county distribution of Red Pine Shoot Blight - 1987.

Red Pine Pocket Mortality - Unknown

Areas of declining and dying red pine in 35 to 40 year old plantations and windbreaks have been observed throughout Central and Southern Wisconsin for several years. Recently, this disease has also been observed in Northern Wisconsin. The symptoms of affected trees are: reduced leader and branch-tip growth, loss of older needles, and fading of needle color. Areas of mortality are typically circular in shape with dead trees in the center of the circular pocket and declining trees along the edge.

A research study by Dr. Ken Raffa and Dr. Eugene Smalley at the University of Wisconsin - Madison was initiated in 1986. Their first year of work concentrated on determining the best attractant and trapping methods for flying and crawling insects such as Ips bark beetles and Hylobius weevils. They also monitored the populations of bark beetles and weevils that were trapped in the affected areas, and isolated from trapped insects for pathogenic fungi. Their goals are to:

1) Determine the sequence of events that lead to mortality by monitoring insect and fungus populations and interactions in red pine pockets.

2) Determine behavior patterns of root weevils that are active in the pockets.

3) Determine what the reactions of the trees are to fungal infections occurring under different stress conditions.

As of January 1, 1988, 32 pockets have been reported and 24 have been investigated (Figure 20). Six pockets were investigated in 1987. Table 4 describes these pockets and lists the insect and disease pests observed.

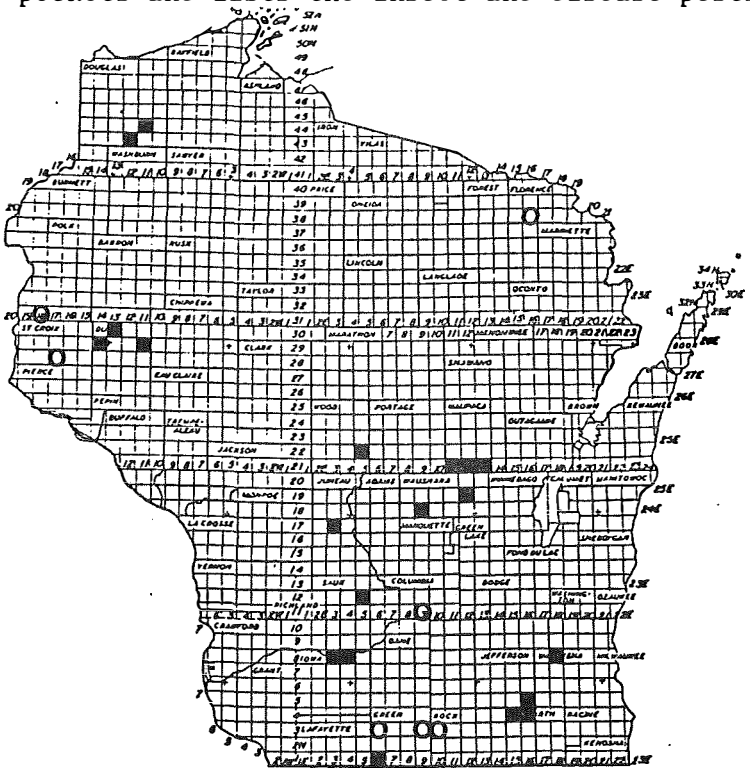


Figure 20. Known township locations of Red Pine Pocket Mortality that have been reported (circles) and investigated (squares) - 1987.

Table 4. Locations of red pine decline and mortality investigated in 1987.

COUNTY	LEGAL DESCRIPTION	DISEASE DESCRIPTION
Waushara	T18N, R9E, Sec 20	A narrow strip of 42 year old red pine adjacent to a younger red pine plantation. None of the affected trees have died. Three adjacent trees are most severely affected. Symptoms decline in severity with distance from this center and end abruptly at the edge of the pocket. Symptoms are extreme growth loss for several years and yellow, short needles. No flagging. Understory of 7 - 8 year old red and white pine.
Waushara	T19N, R12E, Sec 6	A 32 year old plantation, thinned approximately 9 years ago. No trees are dead in this pocket. There is approximately 1/2 acre of trees within the plantation that have extremely thin crowns. Many pencil sized roots died at least 2 years ago and many new roots formed at the point of dieback.
Waupaca	T21N, R11E, Sec 15	Mixed red and white pine planted in 1956. A small pocket about 50 feet in diameter with dead red pines (no dead white pine) and red and white pine reproduction in the middle was discovered in 1987. Declining red pines were removed in a 1987 thinning.
Sauk	T12N, R5E, Sec 4	A 40 year old plantation that has been thinned once. The pocket appears to have been present about 6 - 8 years. It is typical with trees loosing vigor over several years and dying at the edge due to Ips attack. The center of the pocket is filling in with brush.
Douglas	T43N, R12W, Sec 4	A 45 year old plantation that has been thinned three times. There are several small pockets (2-4 trees) of dead trees scattered throughout this plantation. Root collar weevil was commonly associated with dead and declining trees.
Douglas	T44N, R11W, Sec 19	A 35 to 40 year old 160 acre plantation with approximately 30 trees dead and dying. Trees along the edge of the pocket may have green foliage but their tops have broken out. Root collar weevil was commonly associated with dead and declining trees and some apparently healthy trees. Some green trees were present in the center of the pocket. Good red pine reproduction was also present in the center of the pocket.

White Pine Needlecast - Scirrhia acicola (Dern.) Siggers

Two new locations of white pine needlecast were observed in 1987 in Sauk and Marathon counties. There are now six counties reporting this disease (Figure 21). In Sauk County, (Sections 34 and 35, T13N, R7E), approximately 50, 80 year old white pine had light defoliation in their lower crowns. The white pine is mixed with red pine.

In Marathon County (Section 15, T27N, R7E), light defoliation was scattered on under and overstory white pine in a 10 acre natural stand behind Mosinee Paper Company's headquarters along Hwy 51.

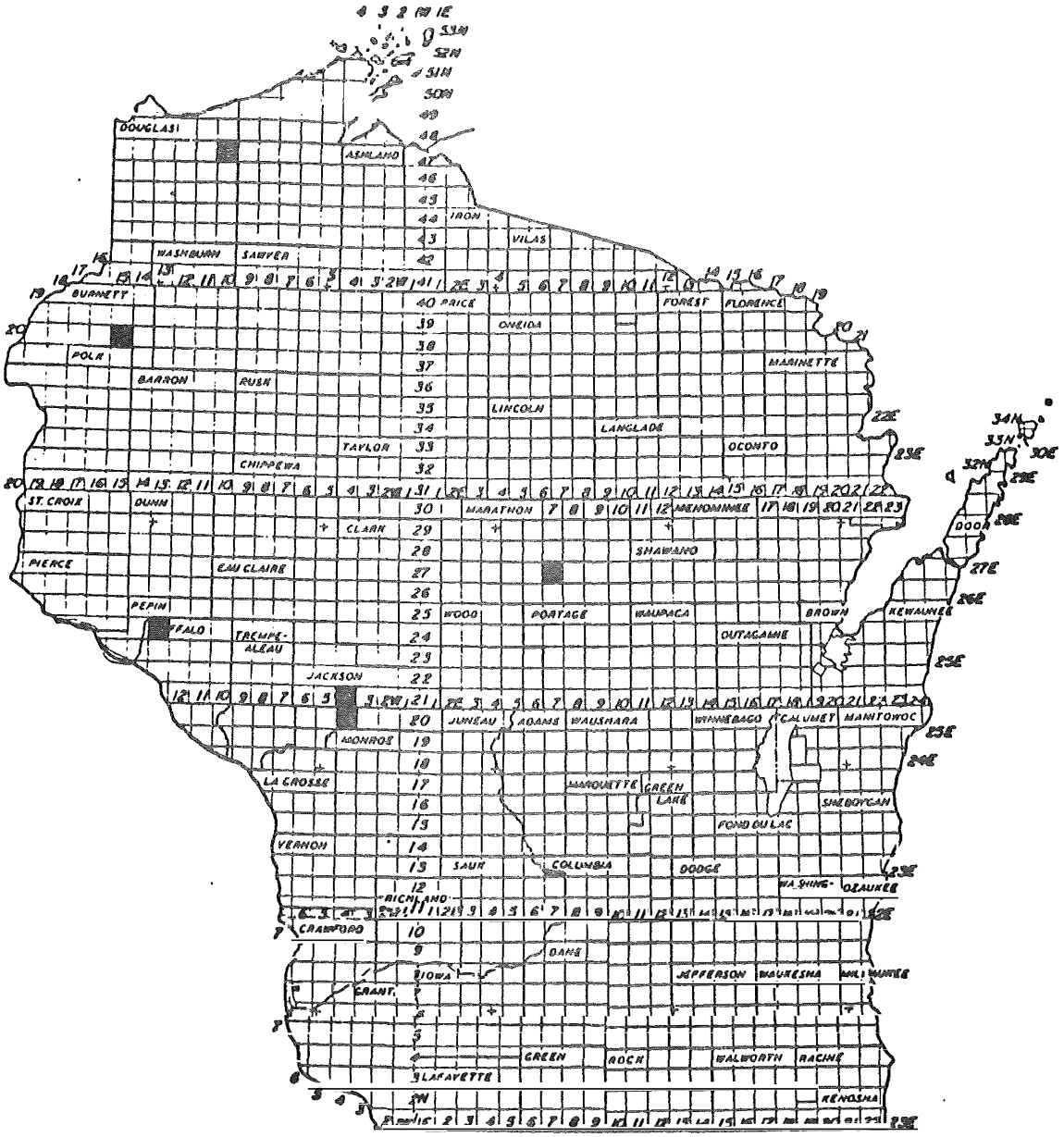


Figure 21. Known township locations of White Pine Needlecast caused by Scirrhia acicola - 1987.

In Burnett County (Sections 5,8, T38N, R15W), where defoliation has occurred for several years over a 3 acre natural stand of white pine, vaseline covered microscope slides were set out in August and September to check for the presence of spores. The slides were placed either within the crowns of defoliating trees, or within 3" of the ground under defoliated trees. There were an insufficient number of spores detected on the slides to determine the best time or location for spore trapping.

In a previously reported location in Jackson County (SESW of Section 2, T21N, R4W), premature (June) defoliation of the one year old needles occurred on approximately 15 trees.

White Pine Needle Blight - Atmospheric Gases

The Bureau of Air Management within the Department of Natural Resources conducted a statewide survey to determine the incidence of white pine with air pollution injury symptoms. The results will be published in a DNR technical report.

Semimature needle blight (SNB) - unknown

Semimature needle blight is an unexplained phenomenon that was first described by Linzon (1960,1966). The initial injury is a faint, pinkish spot on the stomata-bearing faces of needles in semimature (approximately four week old) tissue. The spots develop into orange-red bands which spread to older needle tissue in the apex within a few days. SNB differs from ozone injury in that mottling or translucent spots are present on ozone affected needles and not on SNB affected needles. Sulfur dioxide injury may also be confused with SNB symptoms, but sulfur dioxide usually turns all needles within a fascicle brown to some degree and SNB may only affect one needle within a fascicle.

White pine trees with SNB were scattered throughout Central Vilas County (Figure 22). Symptoms were first observed in mid-July when the needle tips turned red. By September, the red needle tips had turned brown. Needles with brown tips were scattered throughout the crowns of affected trees.

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Jack Pine Budworm - Choristoneura pinus (Rohwer)

Populations were very low in the old outbreak area in the northwestern counties. Light to moderate populations were observed in Adams and Polk counties.

Pine Tussock Moth - Dasychira pinicola (Dyar)

Populations continued at very low levels in the old outbreak areas of Douglas and Bayfield counties.

Figure 22. Area of white pine with symptoms of Semimature Needle Blight - 1987.

European Pine Sawfly - Neodiprion sertifer (Geoffroy)

Defoliation decreased in the southeastern counties where larval colonies were difficult to find during a parasite survey.
Parasitism was extremely low.

In Southwestern Wisconsin defoliation remained stable. A new infestation was found in Western Dane County.

Red Pine Sawfly - Neodiprion nanulus nanulus Schedl

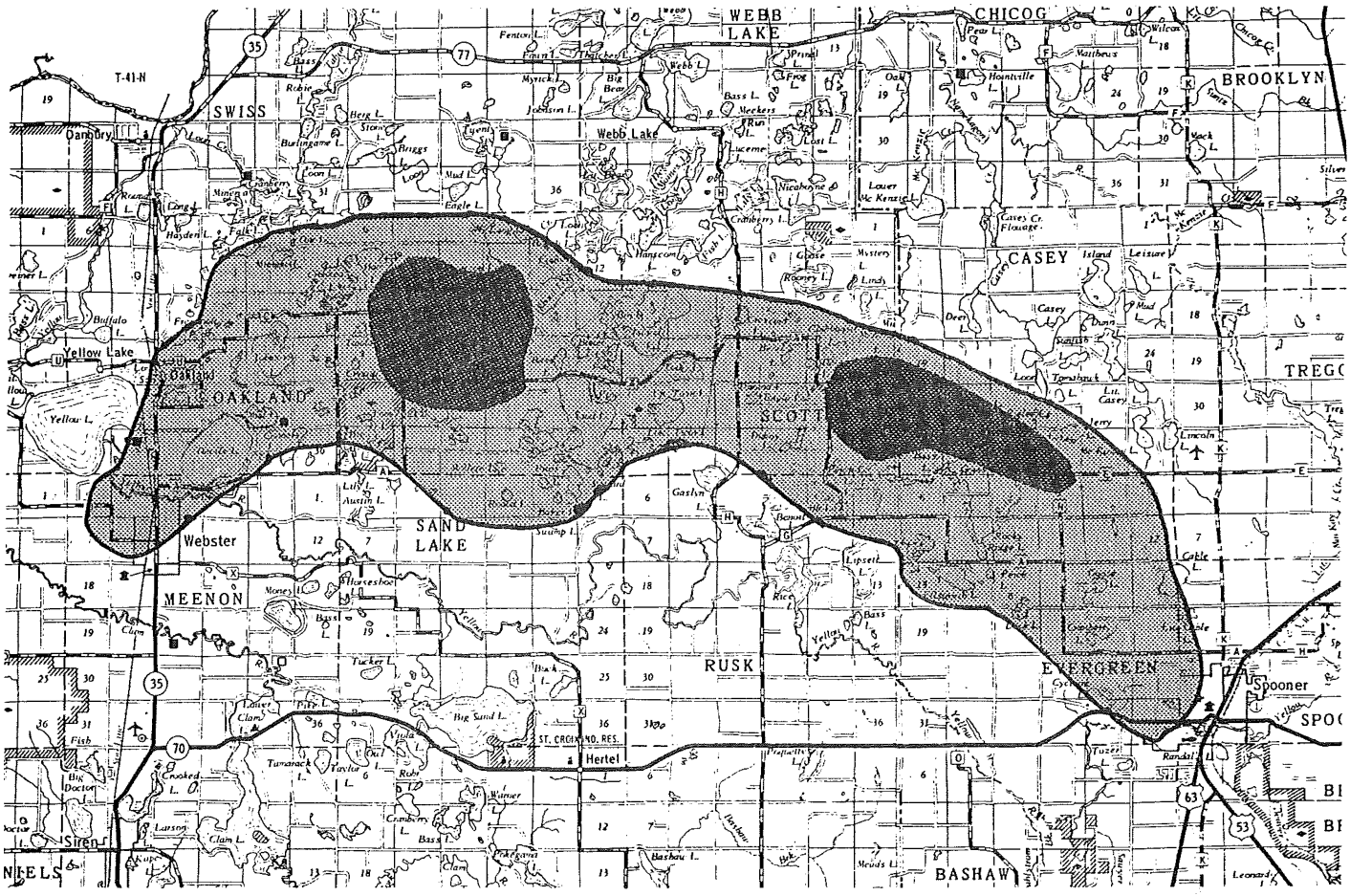
Numbers decreased along the lower Wisconsin River in Iowa and Sauk counties after last years "mini outbreak".

Redheaded Pine Sawfly - Neodiprion lecontei (Fitch)

Light to moderate defoliation occurred on natural jack pine in Burnett and Washburn counties. Populations collapsed after the first generation and no late-season defoliation was observed.

Red Pine Needle Midge - Thecodiplosis piniresinosae Kearby

A new outbreak began this year. Late-season browning of needles in scattered pockets were apparent in the northern two thirds of Wisconsin. In Burnett and Washburn Counties, 57,000 acres of pole sized red pine suffered light defoliation and 13,000 acres suffered moderate defoliation (Figure 23).



Heavy defoliation. Light to moderate defoliation.

Figure 23. Area of defoliation by the Red Pine Needle Midge - 1987.

Red Pine Shoot Moth - Dioryctria resinosella Mutuura

Populations increased dramatically in Jackson, Columbia, Marquette, Sauk and Adams counties. Lateral shoots on edge trees were attacked; no damage to terminals of interior trees was observed.

Eastern Pine Shoot Borer - Eucosma gloriola Heinrich

A general decline in numbers of attacked Scotch pine shoots was apparent in Central Wisconsin; however, Christmas tree growers are still plagued by this boring insect. A few red pine shoots were attacked in Marquette County.

Saratoga Spittlebug - Aphrophora saratogensis (Fitch)

The damage from 1986 feeding in Douglas and Bayfield counties became evident this year. Over 1000 acres of red pine plantations showed heavy to severe damage with dead trees in pockets as large as 50 acres. This population declined in 1987 and caused no further damage to red pine plantations. No other damage was observed in Wisconsin.

Pine Tortoise Scale - Toumeyella parvicornis (Cockerell)

Incidence of this sucking insect increased in the south central counties. A small but heavy infestation damaged Scotch Pine Christmas trees in Waushara county.

Pine Root Collar Weevil - Hylobius radicis (Buchanan)

Damage to red and Scotch pine in the central counties continued at a relatively high level. Untreated Scotch pine Christmas trees continued to die at about the same level as in 1986. Occasional red pines were tipped over and others turned brown when near infested Scotch pine.

Increasing numbers of 15 - 20 foot red pines are being killed in Burnett and Washburn counties. Most of the trees at risk are open grown and are on light, sandy soil. This mortality does not appear to be associated with infested Scotch pine and is becoming a major concern in the area.

Pine Root Tip Weevil - Hylobius rhizophagus Millers, Benjamin & Warner

Damage remained at about the same as 1986 levels. Small infestations continued in Jackson County where red pine had been planted without removing jack pine. Two new locations were observed in Polk and Bayfield counties.

A two-acre infestation in 5 - 9 inch red pine was reported in Adams County. The damaged area was clearcut and the remaining jack pine removed.

White Pine Weevil - Pissodes strobi (Peck)

Populations remained generally low with a few new pockets of moderate to heavy damage reported.

A heavy population was observed in 8 year old red pine in Bayfield County.
Heavy damage to jack pine reproduction was observed in Burnett County.
A grower reported moderate damage to white pine in Sauk County.

A survey for parasites of the white pine weevil was initiated in a low level population area in Clark and Jackson counties. Parasites were reared from attacked white pine, jack pine, blue spruce and Norway spruce from 10 locations. The following species of hymenopterous parasites were identified by Steven Krauth, Department of Entomology, University of Wisconsin:

Pteromalidae	Rhopalicus pulchripennis
Eurytomidae	Eurytoma pissodis
	Eurytoma tylodermatis
Braconidae	Coeliodes pissodis
Eulophidae	Sympiesis sp.

Northern Pine Weevil - Pissodes approximatus (Hopkins)

Young, drought-stressed red pine plantings were attacked in increasing numbers in Northern Wisconsin. Five to ten percent of the trees in scattered 5 - 10 year old plantings were killed in the northwestern counties. Increased mortality was also observed in Oconto, Oneida and Forest counties.

Pine Engraver - Ips pini (Say)

Mortality of scattered pines increased only slightly in Sauk, Iowa and Grant counties after the third consecutive warm dry spring coupled with a very hot dry summer.

Populations generally increased in Northern Wisconsin due to the drought conditions. Pole sized jack pine were killed and red pine tops were killed near a timber sale in Eastern Eau Claire.

Red Turpentine Beetle - Dendroctonus valens LeConte

Damage remained stable or declined slightly in most areas.

White Grubs - Phyllophaga sp.

Damage to new pine plantings was generally reduced from 1986 levels but caused scattered mortality in Northern Wisconsin.

A late summer survey of a Jackson County Forest planting site found an average of one grub per square foot; most were full grown larvae. The area has a history of planting failure due to grub damage. Replanting was postponed.

Plains Pocket Gopher - Geomys bursarius

Considerable damage from gopher occurred throughout Douglas and Bayfield counties and in Northern Burnett and Washburn counties. Red pines from 3 - 10 years old were killed with mortality exceeding 5% in many plantations.

Red Pine Seed And Cone Insects

A small test was conducted in the red pine seed orchard near Avoca in Iowa County to learn if Bacillus thuringiensis and fenvalerate are effective in preventing insect damage to the seed crop.

B.t. (Dipel 8L) was mixed at a rate of 2 1/2 pints per 100 gal. water. Fenvalerate (Pydrin 2.4EC) was mixed at a rate of 11 fl. oz per 100 gal. water. Five gallons of each mixture was applied per tree to 30 trees. Fenvalerate was applied three times during the spring and summer; B.t. was applied twice. From observation and during harvesting of the cones, it was evident that the B.t. gave some protection from the lepidopterous insects and that the fenvaerate gave more protection. Final results will be published in a future report.

The results of a 1984 test of carbofuran for seed and cone insect control was published in 1987; see: Rush, P.A. et. al. 1987. Carbofuran trials in a red pine seed orchard. Nor. Jour. Appl. For. 4:177-180.

SPRUCE

Yellowheaded Spruce Sawfly - Pikonema alaskensis (Rohwer)

Populations were heavy in Northwestern Wisconsin where complaints ran at an all-time high. A white spruce Christmas tree plantation was severely defoliated in Washburn County.

Spruce Needle Rust - Chrysomyxa spp.

In Vilas County, six white spruce and two Colorado blue spruce, approximately 18 years old were infected with Chrysomyxa needle rust. In northern Lincoln County, (Section 22, T35N, R6E), a 40' tall Colorado blue spruce was infected with spruce needle rust. The tree is located at the Duck Point Resort, Tomahawk.

WALNUT

Plantation Black Walnut Canker - Flush Cut Pruning and/or Fusarium sporotrichioides Sherb.

One report of a new location of walnut canker occurred in 1987 in LaCrosse County (SENW of Section 29, T29N, R16W), (Figure 24). The cankers appear to have originated from flush pruning cuts. Isolations from the cankers have not been done yet so the presence of the pathogenic fungus Fusarium sporotrichioides has not been confirmed. Infected trees are scattered throughout a 15 year old plantation located in a valley bottom. Trees were examined on eight, .1 acre plots and 37% of the trees observed were cankered (10 trees cankered and dead, 14 trees cankered).

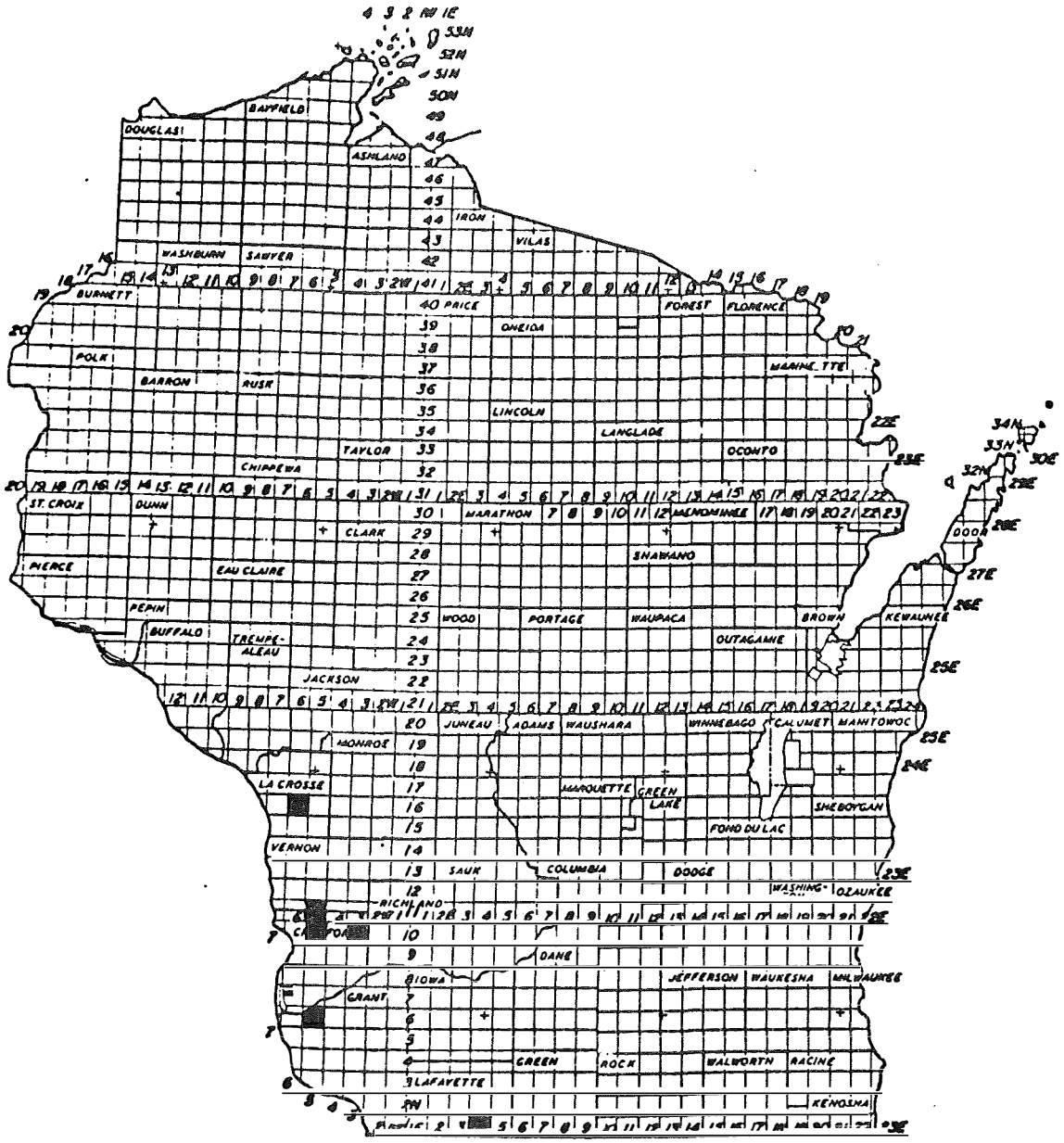


Figure 24. Known township locations of Walnut Canker - 1987.

An attempt to eradicate walnut canker and prevent new infections was made in two walnut plantations : Grant County (Sections 10,4, T6N, R5W) and Vernon County (Section 18, T11N, R5W). All infected trees were marked and removed. These areas will be surveyed for the presence of new infections. All the infected trees in one plantation in Crawford County (Section 2, T10N, R5W), were marked in October, 1987, and will be removed over the winter.

Walnut Caterpillar - Datana integerrima Grote & Robinson

Populations remained very low; only scattered defoliation of walnuts was reported.

A Leaf Beetle - Paria quadrinotata(Say)

Localized heavy feeding on buds in the spring before budbreak is causing deformity of young plantation black walnuts in Richland County. The beetles are easily missed because they feed only at dusk. A few individual beetles have been observed in Iowa and Dane counties.

MISCELLANEOUS SPECIES

Gypsy Moth - Lymantria dispar (L.)

The number of adult males caught in pheromone traps increased from 33 in 1986 to 72 this year. The following table was taken from a summary provided by Wisconsin Department of Agriculture.

Table 6. Numbers of adult male gypsy moths caught in traps in Wisconsin in 1987.

County	No. of Adult Males
Ashland	1
Brown	1
Dane	7
Door	3
Fond du lac	1
Kenosha	2
Lafayette	1
Manitowoc	4
Marinette	12
Milwaukee	7
Ozaukee	9
Sauk	1
Washington	6
Waukesha	17
Winnebago	1
Total	73

No moths were caught in old infestations. Possible new infestations were detected in Dane, Door, Marinette, Ozaukee and Washington counties.

Fall Webworm - Hyphantria cunea (Drury)

The numbers of webs increased noticeably in the central counties. A few webs were observed in the northwestern counties of Washburn, Burnett, Douglas, Bayfield and Sawyer. Elsewhere the numbers remained very low.

An Armyworm-like Caterpillar - Magusa orbifera (Walker)

This obscure caterpillar has done heavy defoliation to buckthorn brush in the Black River Falls area of Jackson County for the second straight year.

Appendix A

WHITE PINE OUTPLANTING SURVIVAL STUDY, 1987

By John Trobaugh[1], James Storandt[2], and Jane Cummings Carlson[3]

Introduction

During the past several years there has been a root rot in the white pine (Pinus strobus L.) seedlings at the Wilson State Nursery, Boscobel, WI and Griffith State Nursery, Wisconsin Rapids, WI. The cause of the root rot is not known, but a sorting process was developed to remove the diseased seedlings before shipping. The objective of this study was to determine if there was a difference in outplanting survival between the sorted good and root rot cull seedlings, and if the sorted good seedlings were capable of surviving after outplanting.

Methods

Seedlings were selected from the Wilson Nursery on April 7, 1987. Approximately 50 3-0 white pine seedlings were collected from the good pile and cull pile every 45 minutes. Seedlings were stored in a cooler overnight and delivered to the Griffith Nursery on April 8, 1987. Treatments consisted of Wilson Good (WG) and Wilson Cull (WC).

Several rows at the Griffith Nursery were identified as having the same root rot problem and went through the same sorting and seedling selection process. The remaining rows were relatively free of root rot and shipped bulk. This was true for both 3-0 and 2-1 transplants. Treatments consisted of Griffith Good (GG), Griffith Cull (GC), Griffith Bed Run (GBR), Griffith Good Transplants (GGT), Griffith Cull Transplants (GCT), and Griffith Bed Run Transplants (GBRT).

White pine 3-0 seedlings from the Hayward State Nursery, Hayward, WI were included for contrast. These seedlings were part of an inter-nursery shipment that arrived at the Griffith Nursery on April 15, 1987. The shipment had 20% cull because of grubs. Treatment consisted of Hayward Bulk (HB).

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[2]Assistant Nursery Superintendent/Pathologist, Griffith State Nursery, Department of Natural Resources, Wisconsin Rapids, Wisconsin.
[3]Forest Pathologist, Department of Natural Resources, Madison, Wisconsin.

The study site was an old field site on the Griffith Nursery property. The soil was a Plainfield loamy sand (Typic Udipsamments) which was machine tilled before planting. Seedlings from the Wilson and Griffith Nurseries were hand planted on April 8 and 9, while the Hayward Nursery stock was hand planted on April 17, 1987. Any seedlings with mechanical damage were removed from the samples. During the growing season a dense cover of common ragweed (Ambrosia artemisiifolia L.) became established, but no weed control was used.

A randomized complete block design was established with the following characteristics:

9 treatments
30 replications
10 seedlings/treatment/replication
2700 seedlings in the study

Data was limited to whether a seedling was dead or alive and was collected on 5/6/87, 5/27/87, 6/18/87, 7/9/87, 7/31/87, and, 8/25/87. The percent survival was calculated for each 10 seedlings/treatment/replication and an analysis of variance with Duncans multiple range post hoc test was conducted on the percentages. A standard arc sine transformation was performed, but no differences in statistical groupings were found between the percentages and transformed data, so the results presented are percent survivals.

Results and Discussion

Table 1 shows that the WG, GG, and GGT had significantly better survival than the WC, GC, and GCT. It is important to remember that the seedlings were culled because of root rot and not because of size or damage. This disease had a scattered pocket distribution in the rows and is very hard to identify from top symptoms. Without sorting, it would be possible that entire orders consisted of root rotted seedlings.

Figure 1 shows that the statistical groupings were established early and remained constant through the growing season. A very dry growing season occurred in 1987 and the Plainfield sands were droughty, so if there was a problem with the root systems it should have shown up. The high survival rates for the good sorted seedlings indicates that the sorting process was effective.

Table 1. White pine seedling survival, 20 weeks after outplanting at the Griffith State Nursery, 1987.

Treatment	Mean Percent Survival
Wilson Good (WG)	90.7 a[1]
Griffith Good (GG)	86.7 ab
Griffith Bed Run (GBR)	85.7 ab
Griffith Good Transplants (GGT)	83.6 ab
Griffith Bed Run Transplants (GBRT)	79.6 bc
Griffith Cull Transplants (GCT)	73.3 c
Wilson Cull (WC)	58.0 d
Hayward Bulk (HB)	53.7 de
Griffith Cull (GC)	48.0 e

[1]Means followed by the same letter are not significantly different at the 0.05 level using the Duncan multiple range test.

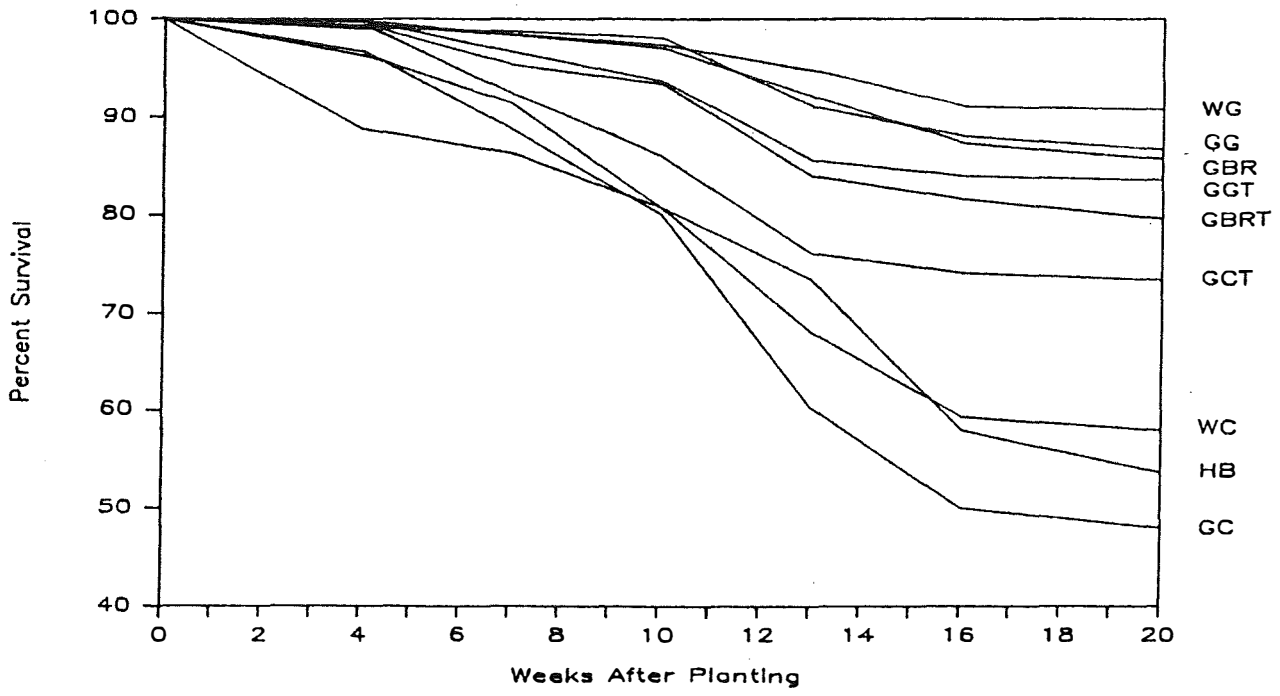

Figure 1. White pine outplanting survival during the 1987 growing season at the Griffith State Nursery.